

# **ASSEMBLY INSTRUCTIONS**

## **OHR 400**

**Oak Hills Research  
20879 Madison Street  
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# **Introduction**

Thank you for purchasing the OHR 400 four band transceiver kit. The OHR 400 is a four band transceiver operating on the 20, 30, 40 and 80M band. It features a single conversion superhet receiver with high side LO injection on all bands. The receiver features an RF pre-amp, diode ring mixer, selectable AGC circuit with manual RF gain control, 4 pole crystal ladder filter, selectable 4 pole audio filter, very stable VFO covering 150 Khz on each band, RIT providing  $\pm 1$  Khz of range. The transmitter features 4-5 watts of output and is adjustable from 0 to full output with a rear panel control, very smooth QSK circuit, sidetone generator with level adjust. All panels are pre-punched for the optional lambic keyer kit. The keyer kit can easily be added at any time. Both lambic and manual key jacks are provided in the basic transceiver kit. An alignment tool is also provided for use in aligning the radio.

You will need the following tools and test equipment to assemble and align your kit. Normal hand tools which include long-nose & regular pliers; diagonal cutters; 1/4" nutdriver; a GOOD pair of wire strippers; phillips head screwdriver; .050" allen wrench; small hammer; 25 to 35 watt pencil soldering iron; ruler; magnifying glass. You will also need a frequency counter and oscilloscope capable of reading 25 Mhz signals. You will need a voltmeter to set the AGC idle voltage. A desoldering bulb and desoldering braid are also helpful to have.

Soldering is one of the most important operations you will perform while assembling your kit. About 95% of all kits returned to us for repair have problems caused by poor soldering. A good solder connection will form an electrical connection between two parts, such as a component lead and a circuit board pad. A bad solder connection will prevent an otherwise well constructed kit from operating properly. It is easy to make good solder connections if you will follow a few simple rules. Use the correct type of soldering iron. A 25 to 35 watt pencil soldering iron with a 1/8" or 3/16" chisel tip works best. Keep the soldering iron tip clean. Wipe it often on a wet sponge or cloth, then apply solder to the tip to give the entire tip a wet look. This process is called tinning, and it will protect the tip and enable you to make good connections. When solder tends to "ball" or does not stick to the tip, the tip needs to be cleaned and retinned. ALWAYS use ROSIN CORE, radio type solder (60:40 tin-lead content) for all the soldering in this kit. The warranty will be void and we will not service any kit in which acid core solder or paste has been used.

# **ASSEMBLY NOTES**

There are three circuit boards (four if you have the optional keyer) in the kit. The three boards are the receiver (40-177); oscillator (40-180); T/R (40-175). Each board is supplied with it's own parts list and parts pack. There are also separate parts packs for the chassis parts and hardware. Each parts list contains a PART ID # and REF DES #. Use the PART ID # and the parts pictorial sheet to help identify parts. The REF DES # is used on the schematic diagram and PC board to identify individual parts. **DO NOT** unpack all the parts packs at one time. Only unpack the parts for the board you are about to work on. We have included a schematic diagram and large, blown-up parts overlay for each board. Some parts may be supplied on a tape. Use your cutters to cut the component leads from the tape. Never pull the components from the tape. All components are mounted on the component screen side of the board (except where noted). All components are positioned down against the board unless noted otherwise.

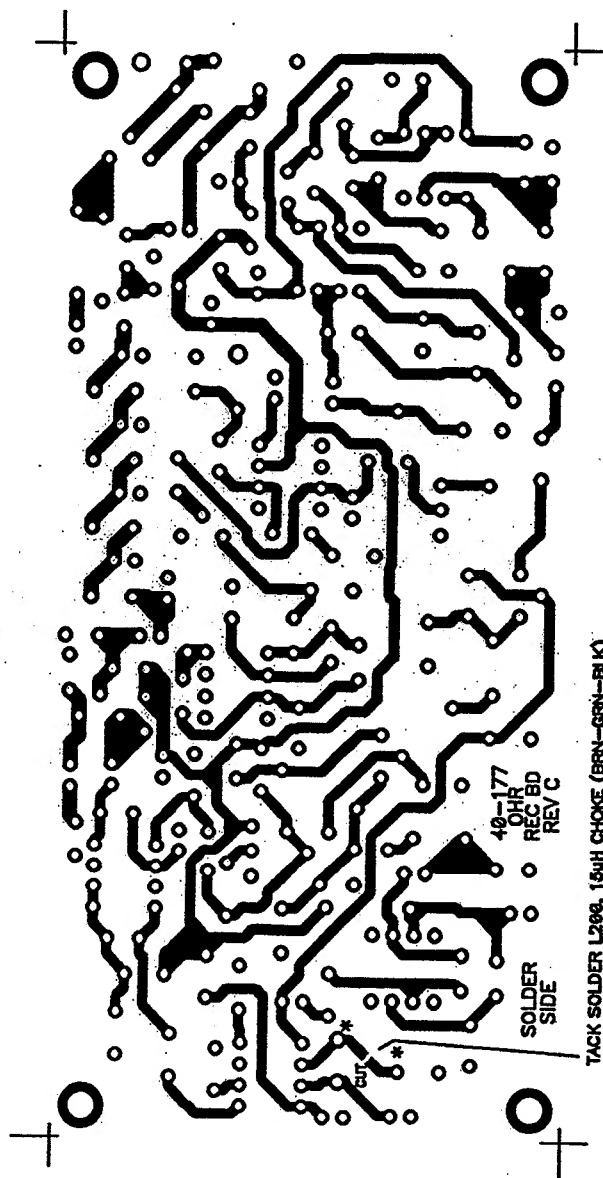
The PC boards supplied in this kit are double-sided with plated-thru holes. The top side (component screen side) of the board is ground. The optional keyer board is single-sided and does not have plated-thru holes. When you assemble the PC boards, **BE ABSOLUTELY SURE YOU HAVE THE CORRECT COMPONENT IN THE CORRECT LOCATION BEFORE SOLDERING IT IN PLACE! DOUBLE CHECK YOUR WORK BEFORE SOLDERING!** With plated-thru holes, once you have soldered a component in place, and then want to remove it, it is more difficult. If you do make a mistake and want to remove a component, follow this simple procedure. Use your desoldering bulb and your desoldering braid to remove ALL solder from the hole. Make sure the component leads are loose and free in the holes before removing the component. Use care when handling the chassis parts. Some may have sharp edges. You should wear eye protection to prevent a cutoff lead clipping from flying up into your eye. As you cut component leads, hold on to the lead as you cut it. If you plan to order the optional keyer kit in the future, be sure to indicate that it is for the OHR 400 transceiver.

The OHR 400 is not difficult to build. Just take your time and use common sense. Don't work too long at one time. Take frequent breaks. **Take the time now to read through all the steps in this booklet before beginning construction of your kit.** This will help you become familiar with the kit and may help prevent mistakes. NOTE: When you unpack the oscillator board parts, you will find a bag labeled "C134" with two yellow mono caps inside. DO NOT remove these caps from the bag until you are ready to install them. These are special TC caps. If you mix them up with the other caps you will not be able to tell which is which.

## **ADDENDUM**

Component L200, a 15uH choke (BRN-GRN-BLK) has been added to the receiver circuit. This choke must be installed on the solder-side of the receiver board (40-177). On the solder-side of the receiver board you will notice a trace that has been cut. This cut trace is in the area of C233 and Y204. After you have completely assembled the receiver board, choke L200 will be installed as follows: Refer to the sheet containing the receiver board bottom foil pattern to help indentify the two pads that L200 will be soldered to. Cut both leads of the 15uH choke to 1/4" from the body. Bend each lead in the same direction 90° to the body. DO NOT twist the leads in the body of the choke. On the bottom side of the board, solder one choke lead to the pad on one side of the cut and the other choke lead to the other pad on the other side of the cut. Now bend the choke down against the board. L200 is shown on the schematic diagram and the parts list.

**OAK HILLS RESEARCH**



TACK SOLDER L200, 15uH CHOKE (BRN-GRN-BLK)  
ACROSS THE CUT TRACE AND TO THE PADS MARKED WITH AN (\*)

40-177  
OHM  
REC'D  
REV C

SOLDER  
SIDE

40-177  
BOTTOM FOIL

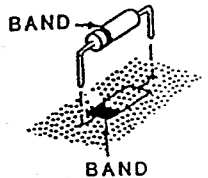
## **RECEIVER BOARD ASSEMBLY**

- ( ) **Locate the receiver board parts pack. Unpack it and take inventory. Also locate the receiver PC board (40-177).**
- ( ) **Refer to the receiver board parts list and component screen diagram for the following steps. It may be helpful to refer to the parts pictorial to help identify parts.**
- ( ) **Some resistors mount vertically on the board. Refer to the drawing at the right for the correct procedure.**
- ( ) **The REF numbers for the components start at 200 for the receiver board.**
- ( ) **Start by installing the resistors. Install four or five components at a time. Then turn the board over and solder each connection. Trim the leads. Install all resistors following this procedure.**
- ( ) **Install all the .1uF mono caps. Solder and trim leads.**
- ( ) **Install all the .01uF mono caps. Solder and trim leads.**
- ( ) **Install the 1uF mono cap at C231. This cap is yellow in color and is labeled 105. Mount about 1/4" above board.**
- ( ) **Install a .001uF mono caps at C213. Solder and trim leads.**
- ( ) **Install the green .033uF poly cap at C230. Solder and trim leads.**
- ( ) **Install the green .022uF poly cap at C219. Solder and trim leads.**
- ( ) **Install green .01uF poly caps at C224, C225 and C226. Solder and trim leads.**
- ( ) **Install green .0022uF poly caps at C223, C235 and C236. Solder and trim leads.**
- ( ) **Use your magnifying glass to help identify some of the smaller parts.**



## **RECEIVER BOARD ASSEMBLY**

- ( ) Install 330pF NP0 mono caps at C202 and C205. Solder and trim leads.
- ( ) Install 470pF NP0 mono caps at C203 and C206. Solder and trim leads.
- ( ) Install a 560pF NP0 mono cap at C204. Solder and trim leads.
- ( ) Install a 150pF NP0 mono cap at C239. Solder and trim leads.
- ( ) Install an ORG trim cap at C233. Solder and trim leads.
- ( ) Install all the electrolytic caps. Be sure to observe the correct polarity. The longer of the two leads is ALWAYS positive. Solder and trim leads.
- ( ) Install 1N4148 diodes at D200 & D202. Be sure to match up the banded end on the diode with the band on the board. See drawing at right. Solder and trim all leads.
- ( ) Install a 1N5817 diode at D201. Solder and trim leads.
- ( ) Install white trim pots (103) at R219 and R234. Solder and trim leads.
- ( ) Install 9 Mhz crystals at Y200, Y201, Y202, Y203 and Y204. These crystals mount down against the board. Solder and trim leads.
- ( ) Install the 2N5770 transistor at Q201. Position the flat side of the transistor as indicated on the board. Mount the transistor 1/4" above the board. Solder and trim leads.



## **RECEIVER BOARD ASSEMBLY**

- ( ) Slip a white spacer onto the leads of a 2N3866 transistor. This spacer prevents the bottom of the transistor from shorting to the top of the board which is ground. Install the transistor and spacer at Q200. Position down against the board. Solder and trim leads. Install a small red heatsink on Q200.
- ( ) Install a bifilar transformer at T200. Identify the two RED leads and the two GREEN leads. The two RED leads go into the holes labeled "R" and the two GREEN leads go into the holes labeled "G". Position the transformer so it is not touching the heatsink on Q200. Solder and trim leads.
- ( ) Install MPF102 transistors at Q203 and Q204. Position the flat side on the transistor as indicated on the board. Mount the transistor 1/4" above the board. Solder and trim leads.
- ( ) Install a 2N3906 transistor at Q202. Use same procedure as above. Solder and trim leads.
- ( ) Install 8 pin IC sockets at all IC locations. Be sure to position the notch as shown on the board. Solder all pins.
- ( ) At one end of the grey 25 conductor cable, cut the outer jacket back about 1" or enough to expose the wires. Start pulling the wires out of the jacket one or two at a time until all are removed. Discard the grey jacket. These wires will be used for all point to point connections.
- ( ) Cut the following wires to the indicated length:

RED	11"	ORG/RED	12"
ORG	12 1/4"	GRN/WHT	12"
GRN	12"	BLU/RED	10 3/4"
BLU	11 1/4"	BLU/WHT	9 1/2"
WHT	9 1/2"	BLK/WHT/RED	10 3/4"
RED/BLK	10 3/4"	RED/WHT/BLK	9 1/2"



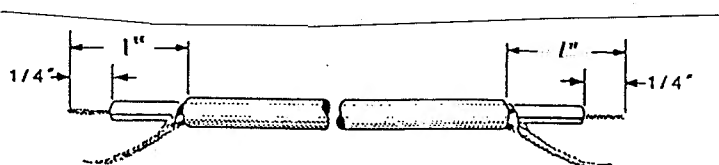
## RECEIVER BOARD ASSEMBLY

- ( ) Remove 3/8" insulation from one end of each wire. DO NOT use a knife or razor blade to remove the insulation. If you cut into the wire strands, you will be constantly repairing broken wires. Use a GOOD pair of wire strippers. With your soldering iron, lightly tin the exposed wires. Remove 1/4" insulation from the other end of each wire. DO NOT tin the wires at this end.
- ( ) In the following step you will install the prepared wires on the receiver board. It is best to install and solder each wire one at a time. Also, when you insert the wire end into the indicated hole, be sure all the wire strands are in the hole. If one or more wire strands are pushed off to the side of the hole this could cause a short circuit to near-by parts.

- ( ) Install the untinned end of the prepared wires at the indicated location.

RED	12V (near C216)
ORG	12VT (near R221)
GRN	S200 (near Q203)
BLU	KEY (near C237)
WHT	S201/1 (near R249)
RED/WHT/BLK	S201/2 (near C241)
BLU/WHT	S201/3 (near C236)
ORG/RED	R223/1 (near C231)
GRN/WHT	R223/2 (near C231)
BLU/RED	R242/3 (near R241)
RED/BLK	R242/2 (near R241)
BLK/WHT/RED	R242/1 (near R241)

- ( ) Locate the length of RG174/U miniature coax cable. Cut two lengths of cable, one 11" and one 14 3/4". Prepare each cable as follows. Carefully remove 1" of the black outer jacket. Be careful not to cut into the braid. Push the exposed braid back so the wire strands separate. Now comb out the braid and then twist together to form a lead. Remove 1/4" of inner conductor insulation. Lightly tin the braid and inner conductor leads. Refer to the drawing below. Prepare both cables using this procedure.

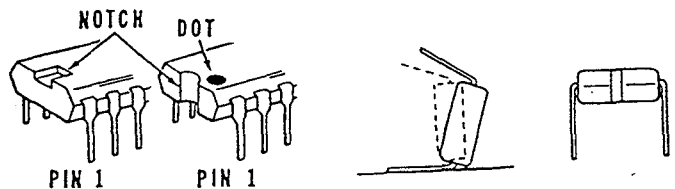


## RECEIVER BOARD ASSEMBLY

- ( ) Install the 11" cable at "J200" on the receiver board. J200 is located near R217. The braid goes in the larger hole. Solder and trim leads. With a small piece of tape label the free end of this cable "PHONES". Install the 14 3/4" cable at "REC IN". These holes are located at the upper left corner of the board. Solder and trim leads. Label the free end "RX IF". The free end of these cables will be connected later.
- ( ) Prepare the ICs for installation as follows. Lay one of the ICs on its side with the end of the pins facing left. Slightly roll the body of the IC to the left so as to make the pins 90° to the body. Turn the IC over and repeat on the other row of pins. See diagram below. Also note the notch or dot and pin 1. Prepare all the ICs for the receiver board using this procedure.

- ( ) Install the ICs as follows:

U200	MC1350P
U203	NE602AN
U205	NE5534N
U204 & U206	TL082CP
U202	LM358N
U201	LM380N-8



- ( ) This completes assembly of the receiver board. Set it aside for now.

## OSCILLATOR BOARD ASSEMBLY

- ( ) Locate the oscillator board parts pack. Unpack it and take inventory. Also locate the oscillator PC board (40-180).
- ( ) Refer to the oscillator board parts list and component screen diagram for the following steps. Also, refer to the parts pictorial to help identify parts.
- ( ) All resistors on this board mount vertically. Refer to drawing on right.
- ( ) Start by installing the resistors. Install four or five components at a time. Then turn the board over and solder each connection. Trim the leads. Install all resistors following this procedure.



## **OSCILLATOR BOARD ASSEMBLY**

- ( ) Use your magnifying glass to help identify some of the smaller parts. Install all the .1uF mono caps. Solder and trim leads.
- ( ) Install all the .01uF ceramic disc caps. Solder and trim leads.
- ( ) Install 680pF NP0 mono caps at C114 & C119. Solder and trim leads.
- ( ) Install 22pF NP0 mono caps at C124, C125 & C127. Solder and trim leads.
- ( ) Install 220pF NP0 mono caps at C126 & C129. Solder and trim leads.
- ( ) Install a 3.3pF NP0 mono cap at C105 and a 6.8pF NP0 mono cap at C144. Solder and trim leads.
- ( ) Install a 100pF NP0 mono caps at C147 and a 180pF NP0 mono cap at C151. Solder and trim leads.
- ( ) Install 10pF ceramic disc caps at C116 & C118. Solder and trim leads.
- ( ) Install 22pF ceramic disc caps at C106, C107, C137 and C160. Solder and trim leads.
- ( ) Install a 5pF ceramic disc cap at C136. Solder and trim leads.
- ( ) Install 33pF ceramic disc caps at C145 & C146. Solder leads.
- ( ) Install 62pF ceramic disc caps at C140 & C141. Solder leads.
- ( ) Install 47pF ceramic disc caps at C121 & C122. Solder leads.
- ( ) Install a 100pF ceramic disc cap at C131. Solder leads.
- ( ) Install black trim caps at C153, C155, C156 and C157. Solder leads.
- ( ) Install a 27pF (270) & a 15pF (150) TC mono cap at C134. These caps are in a bag labeled "C134". DO NOT MIX THESE CAPS UP WITH OTHER CAPS IN THE KIT. Both caps are installed in the same holes. Solder and trim leads. The board component screen has an outline for a trim cap at C134. Two special fixed TC mono caps are now used at this location.
- ( ) All chokes mount vertically, the same as the resistors. Install the following chokes as indicated: 1.5μH at L117 & L118; 4.7μH at L119; 10μH at L120; 100μH at L105. Solder and trim leads.

## **OSCILLATOR BOARD ASSEMBLY**

- ( ) Install the 12 $\mu$ H coil at L104. This coil has a grey base. Solder and trim all leads including the ground tabs.**
- ( ) Install 1.2 $\mu$ H coils at L102, L103, L106, L107, L108 & L109. These coils have a red base. Solder all leads including ground tabs.**
- ( ) Install 3.3 $\mu$ H coils at L110 & L111. These coils have a green base. Solder all leads including ground tabs.**
- ( ) Locate the bifilar transformer. Identify the two red leads and the two green leads. Install this transformer vertically at T100. Insert the two red leads into the holes labeled "R" and the two green leads into the holes labeled "G". From the solder side of the board, pull on each lead slightly to remove any slack in the lead. Solder and trim each lead.**
- ( ) Install the 10K trim pot at R127. Solder each lead.**
- ( ) Install the four crystals at the following locations: 18 Mhz at Y101; 14.000 Mhz at Y102; 11 Mhz at Y103; 7.5 Mhz at Y104. Solder and trim all leads.**
- ( ) Install the 8 pin IC socket at U100. Be sure to position the half-moon end as shown on the board. Solder each pin.**
- ( ) Install 1N4148 diodes at D102, D103, D104, D105, D106, D107, D108, D110, D111 and D112. Solder and trim leads.**
- ( ) Install varactor diode MV2109 at D109. Position the part with the flat side as shown and about 1/4" above the board. Solder and trim each lead.**
- ( ) Using the same procedure as above, install MPN3404 pin diodes at D115, D116, D117 and D118. Solder and trim leads.**
- ( ) Use the same procedure as above when installing transistors and the regulator in the following steps. Install 2N3904 transistors at Q102, Q103 and Q105. Solder and trim leads.**
- ( ) Install a 2N3906 transistor at Q104. Solder and trim leads.**
- ( ) Install a J310 J-FET at Q100. Solder and trim leads.**

## **OSCILLATOR BOARD ASSEMBLY**

- ( ) Install an MPF102 J-FET at Q101. Solder and trim leads.
- ( ) Install the 78L09 regulator at U101. Solder and trim leads.
- ( ) Remove 1/4" of insulation from each end of the short length of large red wire. Install one end at C135. Solder and trim leads. The other end will be connected later.
- ( ) Locate two cutoff leads from a resistor or cap. Form both leads into a "U" shape. Install one at the location labeled "LOOP 1". Leave the loop about 1/4" above the board. Solder and trim leads. Install the second loop at "LOOP 2". Solder and trim leads.
- ( ) Cut the following wires to the indicated length.

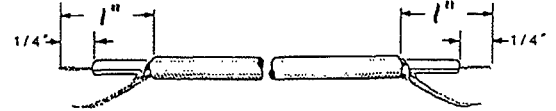
BLK	7 1/2"	ORG/GRN	11 1/4"
		GRN/BLK	9 1/2"
WHT	10 1/2"	BLU/WHT	10"
BLK/WHT	7 1/2"	WHT/RED	9 1/2"
RED/GRN	9"	GRN/BLK/WHT	7 1/2"

- ( ) Remove 3/8" of insulation from one end of each wire. Lightly tin the exposed wires. Remove 1/4" of insulation from the other end of each wire. Do not tin this end.
- ( ) Install the untinned end of the wires one at a time on the oscillator board at the indicated locations. Solder and trim each lead as you install it.

BLK	R124/1 (near Q104)
GRN/BLK/WHT	R124/2
BLK/WHT	R124/3
WHT	80M (near R129)
BLU/WHT	40M (near R123)
WHT/RED	30M (near R113)
GRN/BLK	20M (near R101)
ORG/GRN	KEY (near D112)
RED/GRN	12V (near C113)

## OSCILLATOR BOARD ASSEMBLY

- ( ) Locate the length of RG174/U miniature coax cable. Cut two lengths of cable, one 12 1/2" and one 5 1/2". Prepare each cable as follows. Carefully remove 1" of the outer black jacket. Be careful not to cut into the braid. Push the exposed braid back so the wire strands separate. Now comb out the braid and then twist together to form a lead. Remove 1/4" of inner conductor insulation. Lightly tin the braid and inner conductor leads. Refer to the drawing below. Prepare both cables using this procedure.



- ( ) Install the 12 1/2" cable at "VFO" located in the upper left corner of the board. The braid goes in the larger hole. Solder and trim leads. Label the free end of this cable "VFO". Install the 5 1/2" cable in the holes labeled "AUX". Solder and trim leads. Label the free end "AUX".
- ( ) Prepare the NE602AN IC for installation. Use the same procedure as was used for the ICs on the receiver board. Install the IC at U100.
- ( ) Cut both leads of a 33pF and 5pF ceramic disc cap to 1/4". These two caps are installed on the bottom solder side of the board. Tack solder the 33pF cap across C153, the black trim cap. Tack solder the 5pF across C155, also a black trim cap. These caps are not shown on the component screen of the board. They are shown on the schematic diagram.
- ( ) This completes the assembly of the oscillator board. Set it aside for now.

## T/R BOARD ASSEMBLY

- ( ) Locate the T/R board parts pack. Unpack it and take inventory. DO NOT open the four band pack bags until instructed to do so. Also locate the T/R PC board (40-175).
- ( ) Refer to the T/R board parts list and component screen diagram for the following steps. Also, refer to the parts pictorial to help identify parts.
- ( ) All resistors on this board mount vertically. Refer to drawing at right.



## **T/R BOARD ASSEMBLY**

- ( ) **Start by installing the resistors. Install four or five components at a time. Then turn the board over and solder each connection. Trim the leads. Install all resistors following this procedure. NOTE: Resistor R358 is not mounted on the board. It will be installed later. Also, do not install R317 at this time. It will be installed in a later step.**
- ( ) **Use your magnifying glass to help identify some of the smaller parts. Install all the .1uF mono caps. Solder and trim leads.**
- ( ) **Install all the .01uF ceramic disc caps. Solder and trim leads.**
- ( ) **Install .001uF mono caps at C321 and C328. Solder and trim leads.**
- ( ) **Install a 1pF NP0 mono cap at C310. Solder and trim leads.**
- ( ) **Install 3.3pF NP0 mono caps at C325 and C342. Solder and trim leads.**
- ( ) **Install a 6.8pF NP0 mono cap at C351. Solder and trim leads.**
- ( ) **Install 10pF ceramic disc caps at C366 & C383. Solder and trim leads.**
- ( ) **Install an 18pF ceramic disc cap at C381. Solder and trim leads.**
- ( ) **Install 12pF ceramic disc caps at C309 and C311. Solder and trim leads.**
- ( ) **Install 15pF ceramic disc caps at C313, C314, C324 and C326. Solder and trim leads.**
- ( ) **Install 33pF ceramic disc caps at C331, C332, C341 and C343. Solder and trim leads.**
- ( ) **Install 51pF ceramic disc caps at C368, C384 and C385. Solder and trim leads.**
- ( ) **Install 56pF ceramic disc caps at C350 and C352. Solder and trim leads.**
- ( ) **Install 68pF ceramic disc caps at C344 and C345. Solder and trim leads.**

## **T/R BOARD ASSEMBLY**

- ( ) Install 180pF ceramic disc caps at C356 and C357. Solder and trim leads.**
- ( ) Install all the electrolytic caps. Be sure to observe the correct polarity. The longer lead is ALWAYS positive. Solder and trim leads.**
- ( ) Open the 20M band pack. Install the components as follows: 120pF ceramic disc caps at C338 & C339; 270pF ceramic disc cap at C340; both coils at L315 & L316. Solder and trim leads.**
- ( ) Open the 30M band pack. Install the components as follows: 220pF ceramic disc caps at C346 & C347; 470pF ceramic disc cap at C348; both coils at L317 & L318. Solder and trim leads.**
- ( ) Open the 40M band pack. Install the components as follows: 330pF ceramic disc caps at C353 & C355; 680pF ceramic disc cap at C354; both coils at L321 & L322. Solder and trim leads.**
- ( ) Open the 80M band pack. Install the components as follows: 680pF ceramic disc caps at C361 & C363; 1200pF poly cap at C362; both coils at L323 & L324. Solder and trim leads.**
- ( ) Install the black trim cap at C386. Solder leads.**
- ( ) Install the 9 Mhz crystal at Y300. Solder and trim leads.**
- ( ) Install the TUF-1 mixer at U302. Be sure outline of part matches outline on the board. Solder all four leads.**
- ( ) All chokes mount vertically, the same as the resistors. Install 100 $\mu$ H chokes at the following locations: L305, L310, L311, L314, L325, L328, L329, L330 and L331. Solder and trim leads.**
- ( ) Install a 22 $\mu$ H choke at L332. Solder and trim leads.**
- ( ) Install an IF transformer (42IF123) at T304. Solder all leads including the ground tabs.**
- ( ) Install the 8 $\mu$ H (T1008) coils at L326 & L327. Solder all leads including the ground tabs.**
- ( ) Install 4.7 $\mu$ H (T1005) coils at L303, L304, L312, L313, L319 and L320. Solder all leads including the ground tabs.**



## **T/R BOARD ASSEMBLY**

- ( ) **Locate one of the bifilar transformers. Identify the two red leads and the two green leads. Install this transformer vertically at T300. Insert the two red leads into the holes labeled "R" and the two green leads into the holes labeled "G". From the solder side of the board, pull on each lead slightly to remove any slack in the lead. Solder and trim each lead.**
- ( ) **Using the same procedure as above, install bifilar transformers at T301, T302 and T303. Solder and trim each lead.**
- ( ) **Install 1N4007 diodes at D313 & D314. Solder and trim leads. NOTE: Diodes D325 & D327 are not board mounted. They will be installed later.**
- ( ) **Install 1N4148 diodes at D302, D303, D304, D305, D306, D307, D308, D309, D310 and D311. Solder and trim leads.**
- ( ) **Continue installing 1N4148 diodes at D312, D316, D318, D319, D320, D321, D322, D323, D324 and D326. Solder and trim leads.**
- ( ) **Install the 100 ohm PC pot with long white shaft attached to it at R317. Position this pot so the shaft extends over the near edge of the board. This pot fits very tightly into the holes, but it will fit into the holes. Solder all three leads.**
- ( ) **Install the 2N5179 transistor at Q305. Position the transistor so the small location tab matches the board outline. Also, position about 1/8" to 1/4" above the board. Solder and trim leads.**
- ( ) **Using the same procedure as above, install the 2N2222A transistor at Q302. Solder and trim leads.**
- ( ) **Slip a white spacer onto the leads of a 2N3866 transistor. This spacer prevents the bottom of the transistor from shorting to the top of the board which is ground. Install the transistor and spacer at Q301. Position down against the board. Solder and trim leads. Install a small red heatsink on Q301.**
- ( ) **Using the same procedure as above, install a 2N3053 transistor at Q307. Solder and trim leads. A heatsink is not used on Q307.**
- ( ) **Install 2N3904 transistors at Q303, Q308, Q309 and Q310. Position the transistor with the flat side as shown on the board and about 1/4" above the board. Solder and trim leads.**

## **T/R BOARD ASSEMBLY**

- ( ) Continue by installing 2N3906 transistors at Q304 and Q306. Solder and trim leads.
- ( ) Install an MPF102 J-FET at Q311. Solder and trim leads.
- ( ) Install the 2SC2075 transistor at Q300. This transistor mounts from the bottom of the board and hangs over the near edge. Insert the leads into the holes from the bottom until the ends of the leads are just protruding through the top holes. Be sure the flat body of the transistor is parallel to the board. Now solder the leads from the TOP of the board.
- ( ) Locate the (8) reed relays. Lay one of the relays on its side on a flat surface with the ends of the pins facing to the left. Grasp the body of the relay and gently roll it to the left a small amount so as to make the pins 90 deg to the body of the relay. Flip the relay over and repeat on the other row of pins. This procedure will make it much easier to install the relays on the board. Repeat this procedure on the remaining relays.
- ( ) Notice there is a dot at one end of the relay on top. When you install the relays in the following step, be sure to match this dot end with the half-moon notch on the board. Also, the relays are soldered directly on the board, no sockets are used.
- ( ) Install relays at K302, K303, K304, K305, K306, K307, K308 and K309. Solder all pins.
- ( ) Except for wires and cables, all components should be installed and soldered on the T/R board at this time. Look over the board for unsoldered or improperly soldered connections. Check for solder bridges. Set the T/R board aside for now.
- ( ) Cut the following wires to the indicated length.

BLK	7"	WHT/RED	5 1/4"
BLK/RED	7"	BLK/WHT/RED	9"
BLK/RED	8"	RED/BLK/WHT	9 1/4"
BLK/WHT	5 3/4"	GRN/BLK/WHT	8"
RED/GRN	5 1/4"	WHT/RED/BLK	8 3/4"
GRN/BLK	5 1/4"	WHT/RED/BLK	8 1/4"

## **T/R BOARD ASSEMBLY**

- ( ) On the RED/GRN, WHT/RED, GRN/BLK and BLK/WHT wires remove 1/4" of insulation from both ends of each wire. Do not tin the ends of these wires.
- ( ) These four wires are used as jumpers on the T/R board. Install each jumper one at a time at the indicated locations. Solder and trim each lead as you install it.

RED/GRN - JU2 to JU2  
WHT/RED - JU3 to JU3

GRN/BLK - JU4 to JU4  
BLK/WHT - JU5 to JU5

- ( ) On the remaining pre-cut wires remove 3/8" insulation from one end of each wire. Lightly tin the exposed wires. At the other end of each wire, remove 1/4" insulation. Do not tin this end.
- ( ) Install the untinned end of the remaining prepared wires at the indicated locations. Solder and trim each wire as you install it.

BLK/RED (7")	12V (near R302)
BLK	KEY (near R356)
WHT/RED/BLK (8 3/4")	12VT (near Q308)
GRN/BLK/WHT	12V (near R349)
BLK/RED (8")	80M (near K309)
WHT/RED/BLK (8 1/4")	40M (near K307)
BLK/WHT/RED	30M (near K305)
RED/BLK/WHT	20M (near K303)

- ( ) Prepare a 6" length of miniature coax cable using the same procedure as before. Install one end in the holes labeled "ANT". These holes are located at the lower right of the board. Solder and trim leads. The free end will be connected later. Set the T/R board aside for now.

## **CHASSIS ASSEMBLY**

- ( ) Be careful when handling the chassis parts, some may have sharp edges.
- ( ) Locate the chassis and refer to assembly pictorial, Fig 1. Position the chassis as shown in Fig 1. With a permanent felt tip marker, mark the location of each hole on the top and bottom of the chassis. Also, label the top and bottom of the chassis.

## **CHASSIS ASSEMBLY**

- ( ) Install a 1/2" grommet in holes J & M. See Fig 1. Label the grommet in hole J as "J" and the one in hole M as "M".
- ( ) In the following steps when a screw size is called for such as 4-40 x 1/4", the 1/4" is the length of the screw as measured along the threaded portion. If you are not sure of the size, use your ruler to measure it.
- ( ) Place a #4 lockwasher on a 4-40 x 1/4" screw. From the bottom side of the chassis, insert it through hole "S". On the top side of the chassis, start a round aluminum spacer on the screw. Tighten the screw. Refer to Fig 2. Using the same procedure, install round spacers at holes A, B, F, G, H, K & L. Tighten all screws.
- ( ) Still referring to Fig 2, place a #4 solder lug on a 4-40 x 1/4" screw. From the bottom of the chassis, insert the screw through hole "R". On top of the chassis, start a round spacer on the screw. Position the solder lug so it points to the front of the chassis. Tighten the screw.
- ( ) Place a 4-40 x 1/4" screw through the mounting hole of a four lug terminal strip. From the top of the chassis, insert the screw through hole "N". On the bottom of the chassis, secure with a #4 lockwasher and hex nut. Position the terminal strip parallel to the side of the chassis as shown. Tighten the nut. Label this terminal strip TB1. Also, label the lugs 1 - 4 as shown.
- ( ) Turn the chassis over and refer to Fig 4. Install another terminal strip at hole "O" as shown. On top of the chassis, secure with a #4 lockwasher and hex nut. Tighten the nut. Label this terminal strip TB2. Label the lugs as shown.
- ( ) Install the last terminal strip at hole "I" as shown. On top of the chassis, start a round spacer on the screw. Position the terminal strip as shown and tighten screw. Label this terminal strip TB3. Label the lugs as shown.
- ( ) Place a #4 lockwasher on a 4-40 x 5/8" screw. From the top of the chassis, insert the screw through hole "P". Start a 1/4" hex spacer. Tighten the screw.
- ( ) Using the same procedure as above, install 1/4" hex spacers at holes C, D & Q.

## **CHASSIS ASSEMBLY**

- ( ) Refer to Fig 3. Place a #4 lockwasher on a 4-40 x 1/4" screw. From the bottom of the chassis, insert the screw through hole T. Position the air variable cap on top of the chassis over holes T & U and start the screw into the machined hole in the bottom of the cap. Repeat at hole U. Position the cap so the front edge is parallel with the front edge of the chassis. Tighten the screws.
- ( ) Locate the two side panels. Place one of the panels on a small block of wood with the end flanges facing down. Start one of the 1/4" square nylon nuts into one of the square holes in the side panel. See Fig 11. With the side panel supported on the block of wood, use your hammer to seat the nylon nut in the hole. Install nylon nuts in the other three square holes. Install four nylon nuts in the other side panel. Mark the top and bottom edges on both panels as shown in Fig 11.
- ( ) Refer to Fig 12 for this step. Place a #4 lockwasher on a 4-40 x 5/16" screw. Insert the screw through one of the small holes in the side panel as shown in Fig 12. Place the chassis along side the side panel so the screw goes through the mating hole in the chassis flange. Secure with a #4 lockwasher and #4 hex nut. Do the same in the other small hole in the side panel. Tighten both screws. Using the same procedure, mount the remaining side panel on the other side of the chassis. Tighten both screws.
- ( ) Position the chassis assembly on your work table so the front edge is facing you with the top side up. Position the oscillator board over the four mating round spacers with the large red wire toward the front. Place a #4 lockwasher on a 4-40 x 1/4" screw. Insert the screw through one of the four board mounting holes and start it into the spacer. Repeat at the other three holes. Tighten all four screws.
- ( ) Carefully form a gentle loop in the large red wire coming from hole C135. Insert the end of the wire into the hole in terminal #1 of the air variable cap. See Fig 7. Push the end of the wire into the terminal just far enough to be able to make a good solder connection. If it goes in too far, it will short to the chassis. Solder the connection.
- ( ) Route the following wires and cables down through grommet J: WHT; BLU/WHT; WHT/RED; GRN/BLK; cable coming from "VFO".
- ( ) Route the following wires through grommet M: ORG/GRN; RED/GRN.

## **CHASSIS ASSEMBLY**

- ( ) Position the assembled receiver board over the four spacers with the red heatsink upper left. Secure the receiver board with #4 lockwashers and 4-40 x 1/4" screws. Tighten all four screws.
- ( ) Route the following wires and cables through grommet J: GRN; GRN/WHT; ORG/RED; cable coming from "REC IN".
- ( ) Route the following wires and cables through grommet M: RED; ORG; BLU; cable coming from J200.
- ( ) In the following steps you will be instructed to make connections to the lugs on the three terminal strips. If more than one wire will be connected to the lug the instruction will be followed by an (N-S). This means connect the wire but do not solder the connection. After all wires are connected to a point, you will be instructed to solder the connection followed by an (S-#). The # will indicate the number of wires at that connection.
- ( ) Turn the chassis over. Connect the following wires coming up through grommet J to the indicated lugs on TB2.

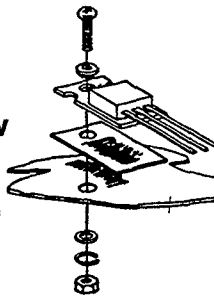
GRN/BLK	LUG 1 (N-S)
WHT/RED	LUG 2 (N-S)
BLU/WHT	LUG 3 (N-S)
WHT	LUG 4 (N-S)

- ( ) Connect the following wires coming up through grommet M to the indicated lugs on TB3.

RED	LUG 1 (N-S)
RED/GRN	LUG 1 (N-S)
ORG/GRN	LUG 2 (N-S)
BLU	LUG 2 (N-S)
ORG	LUG 3 (N-S)

## **CHASSIS ASSEMBLY**

- ( ) Position the chassis bottom side up so the air variable cap is facing you. Position the T/R board with the white shaft facing away from you. Connect the two coax cables coming through grommet J to the T/R board. Install at the location indicated on the marking tape. The braid goes into the larger hole. Solder and trim leads. Position the board over the four protruding screws coming through the hex spacers until all four corner mounting holes are engaged. Start a #4 lockwasher and hex nut at each screw. Be sure there are no wires or cables pinched or crushed under the board. Tighten all four nuts.
- ( ) Open the small plastic bag containing the transistor mounting hardware. Discard the screw. Place the small shoulder washer on a 4-40 x 5/16" screw with the small shoulder away from the screw head. Place the orange colored mica insulator between the chassis and the flat side of the 2075 transistor. Be sure the holes in the transistor, insulator and the chassis are all lined up. Also, be sure the insulator is under the full body of the transistor. Place the screw with the shoulder washer in the hole of the transistor, insulator and chassis. On the top side of the chassis, secure with the flat washer, lockwasher and #4 hex nut. Tighten the nut. See diagram at right.
- ( ) With your ohmmeter make a resistance check between the chassis and the flat portion of the 2075 transistor. The resistance you measure should be several hundred ohms. If it is zero ohms, the collector of the 2075 transistor is shorted to the chassis. This short must be corrected now.
- ( ) Connect the wires coming from the T/R board as follows.



WHT/RED/BLK (12VT)	TB3 LUG 3 (S-2)
GRN/WHT/BLK (12V)	TB3 LUG 1 (N-S)
BLK/RED (12V)	TB3 LUG 1 (N-S)
BLK (KEY)	TB3 LUG 2 (N-S)
RED/BLK/WHT (20)	<u>TB2</u> LUG 1 (N-S)
BLK/WHT/RED (30)	<u>TB2</u> LUG 2 (N-S)
WHT/RED/BLK (40)	<u>TB2</u> LUG 3 (N-S)
BLK/RED (80)	<u>TB2</u> LUG 4 (N-S)

## **CHASSIS ASSEMBLY**

- ( ) Refer to Fig 5 for the following steps. Locate the rear panel. Remove the nut and flat washer from the manual key jack, J301. Install the jack in the rear panel hole labeled "MANUAL KEY". Use the supplied hardware and position the jack as shown in Fig 5. Tighten the nut. Install the keyer jack in the rear panel hole labeled "KEYER". Position as shown in Fig 5. Tighten the nut.
- ( ) Remove the flat washer and nut from the coaxial power jack, J302 and the phono jack. Install the power jack in the hole labeled "13.6VDC". Position the jack as shown in Fig 5. Tighten the nut. Install the phono jack in the hole labeled "OSC OUT". Position the solder lug as shown. Tighten the nut.
- ( ) Refer to Fig 8 for the following steps. Install the SO-239 antenna connector at the rear panel location labeled "ANTENNA". Note that the flange of the connector goes on the outside of the panel. Secure with 4-40 x 5/16" hardware as shown. Position the #4 solder lug as shown in the indicated hole. Tighten all four screws.
- ( ) Install a 6-32 x 5/8" screw in the hole labeled "GND". Use the indicated hardware. Tighten the nut.
- ( ) Position the chassis assembly top side up and the air variable cap facing away from you. Insert the white shaft on the T/R board through the power adj. hole on the panel. Line up the four corner mounting holes. From the outside of the panel, insert a 6-32 x 3/8" screw through one of the mounting holes in the rear panel and the side panel holes. Slide a #6 lockwasher on the screw and start a #6 hex nut. See Fig 8. Leave finger tight. Repeat at the other three holes. Now tighten all four screws.
- ( ) Refer to Fig 7 for the following steps. Locate D327, the panel mounted RED LED. Cut both leads to a length of 4 1/2" from where the wires exit the body. From the front side of the front panel insert the LED assembly into the hole labeled "POWER". Push the LED in until it seats in place. Locate R242/S301, the larger 10K ohm panel pot with the black switch mounted on the rear. With your pliers, break off the small alignment tab on the front edge of the body. Remove the nut and flat washer. Install this pot in the front panel hole labeled "AF GAIN". Place the flat washer on the bushing and start the nut. Position the pot so terminal #3 is in line with the LED assembly above it. This is slightly different than is shown in Fig 7. Tighten the nut.



## **CHASSIS ASSEMBLY**

- ( ) **Locate R124, the 10K ohm center detent panel pot. Remove the flat washer and nut. Break off the alignment tab as before. Install this pot in the front panel hole labeled "RIT". Position pot as shown. Tighten nut.**
- ( ) **Locate S201, toggle switch. Remove the nut and both washers. Install in the hole labeled "FILTER". Position switch as shown. Secure with the flat washer and nut.**
- ( ) **See Fig 6. Install toggle switches S200 and S300 in holes labeled "TUNE/OPERATE" and "AGC". Follow same procedure as above.**
- ( ) **Install J200, the remaining 1/4" phone jack in the hole labeled "PHONES". Position jack as shown in Fig 6. Secure with supplied hardware.**
- ( ) **Locate the 500K ohm panel pot. As before, break off the alignment tab. Install the pot in the front panel hole labeled "SPEED". Position pot as shown in Fig 6. Secure with supplied hardware.**
- ( ) **Locate R223, 10K ohm panel pot. On this pot, just bend the alignment tab out of the way. Install this pot in the front panel hole labeled "RF GAIN". Position pot as shown. Secure with supplied hardware.**
- ( ) **Locate S302, the 4 position rotary switch. Refer to Fig 9 for this step. Bend the alignment tab out as shown. Position the switch as shown in Fig 9 with the alignment tab on the left and the rear of the switch facing you. Identify pins 1 - 5. You might want to put a small black mark next to each of these pins. Now with your diagonal cutters, cut off flush with the back of the switch all unmarked pins. DO NOT rush this step. If you cut off the wrong pins, the switch will be ruined.**
- ( ) **Again refer to Fig 6. Remove the nut and flat washer. Start the nut on the threaded bushing. Continue turning the nut on until two or three threads are showing between the nut and the body of the switch. Install the switch in the front panel hole labeled "80 - 20". Place a flat washer on the bushing and start a large control nut. Rotate the switch a little more to the left than is shown in Fig 6. This is necessary in order that the pointed end of the switch will not interfere with the bottom cover. Tighten nut.**

## **CHASSIS ASSEMBLY**

- ( ) Position the front panel at the front of the chassis assembly so the shaft on the air variable cap goes through the large hole. Secure with a 6-32 x 3/8" screw, #6 lockwasher and #6 hex nut at each of the four corner mounting holes. The air variable shaft should be dead centered in the large hole. Tighten all four screws. Set the radio aside for now.

## **FINAL WIRING**

- ( ) Cut the following lengths of wire:

RED	3 1/2"	ORG/GRN	3 1/4"
GRN	4"	GRN/WHT	3"
BLU	4"	BLU/BLK	10"
RED/BLK	4 1/2"	BLU/RED	8 1/4"
RED/BLK	3 1/2"	WHT/BLK	5"
RED/WHT	14"	WHT/BLK	4"
ORG/BLK	11"	WHT/BLK	2 3/4"
ORG/BLK	2"		

- ( ) Prepare each wire by removing 3/8" insulation from each end of each wire. Lightly tin both ends of each wire.
- ( ) Refer to Fig 6 for the following steps. Connect the following wires to rotary switch S302:

GRN/WHT	PIN 1 (S-1)
ORG/GRN	PIN 2 (S-1)
RED	PIN 3 (S-1)
BLU	PIN 4 (S-1)
RED/WHT	PIN 5 (S-1)

- ( ) Connect the free end of the wires just installed on S302 to TB2 as follows:

GRN/WHT	LUG 1 (S-3)
ORG/GRN	LUG 2 (S-3)
RED	LUG 3 (S-3)
BLU	LUG 4 (S-3)

- ( ) Route the free end of the RED/WHT wire down through grommet M.

## **FINAL WIRING**

- ( ) Still referring to Fig 6, connect the wires coming through grommet J as follows:  
  
GRN/WHT R223/2 (N-S)  
ORG/RED R223/1 (N-S)  
GRN S200/1 (S-1)
- ( ) Connect one end of the 5" WHT/BLK wire to R223/3 (S-1). Connect the other end to the #4 solder lug at hole R (N-S). Cut both leads of a 2.2K (RED-RED-RED) ohm resistor to 3/8". Connect one lead to R223/1 (S-2). Connect the other lead to R223/2 (S-2).
- ( ) Connect one end of the 4" WHT/BLK wire to S200/2 (S-1). Connect the other end to the #4 solder lug at hole R (N-S).
- ( ) Connect one end of the 2 3/4" WHT/BLK wire to S300/2 (S-1). Connect the other end to the #4 solder lug at hole R (S-3).
- ( ) Connect one end of the 8 1/4" BLU/RED wire to S300/3 (S-1). Route the free end through grommet M.
- ( ) Connect one end of the 4 1/2" RED/BLK wire to TB3 lug 1 (S-5). Route the free end through grommet M.
- ( ) Connect one end of the 4" GRN wire to TB3 lug 2 (S-4). Route the free end through grommet M.
- ( ) All connections on TB2 and TB3 should now be soldered.
- ( ) Connect the free end of the coax coming from grommet M to J200. The braid connects to lug 1 (S-1) and the inner conductor to lug 3 (S-1).
- ( ) Route the remaining coax from the T/R board down against the chassis between TB3 and grommet M, along the chassis to the SO-239 antenna connector. Solder the inner conductor to the center pin of the connector and the braid to the solder lug.
- ( ) Position the radio upright with the rear panel facing you. Cut both leads of a 4.7K (YEL-VIO-RED) ohm resistor to 3/8". Connect between lugs 1 & 2 of TB1 (N-S). Connect the RED lead from D327, the front panel LED, to TB1 lug 1 (S-2). Connect the WHT lead from the LED to the center, unmarked ground lug of TB1 (S-1).

## **FINAL WIRING**

- ( ) Connect the RED/BLK and the RED/WHT wires coming from grommet M to TB1 lug 2 (N-S). Connect one end of the 3 1/2" RED/BLK wire to TB1 lug 2 (N-S). Connect the free end to S301 lug 5 (S-1). S301 is the switch on the rear of the AF GAIN control. See Fig 7.
- ( ) Connect one end of the 10" BLU/BLK wire to S301 lug 4 (S-1). The free end will be connected shortly.
- ( ) Connect the GRN wire coming from grommet M to TB1 lug 3 (N-S). Connect one end of the ORG/BLK wire to TB1 lug 3 (N-S). Connect the other end to J301 lug 3 (S-1). J301 is on the rear panel. See Fig 5.
- ( ) Connect the BLU/RED wire coming from grommet M to TB1 lug 4 (N-S).
- ( ) If you are NOT installing the keyer kit at this time, perform the next step. If you are installing the keyer kit at this time, skip the next step.
- ( ) Connect one end of the 2" ORG/BLK wire to TB1 lug 3 (S-3). Connect the other end to TB1 lug 4 (S-2). Solder the connection at TB1 lug 2 (S-4).
- ( ) Cut both leads of a 1N4007 diode to 3/8". Connect the BANDED end to J302 lug 1 (N-S). Connect the other lead to J302 lug 2 (S-1). Be sure you have the lug numbers on J302 identified correctly. See Fig 5. Connect the free end of the BLU/BLK wire to J302 lug 1 (S-2).
- ( ) Connect the free end of the coax cable coming from the oscillator board (AUX) to the phono jack on the rear panel labeled "AUX" in Fig 5. Solder the inner conductor to the center pin and the braid to the solder lug.
- ( ) Refer to Fig 7 for the following steps. Connect the free end of the BLU/RED wire to R242 lug 3 (S-1). Connect the RED/BLK to R242 lug 2 (S-1). Connect the BLK/RED/WHT wire to R242 lug 1 (S-1). Be sure this wire is the one coming from R242/1 on the receiver board.
- ( ) Connect the BLU/WHT wire to S201 lug 3 (S-1). Connect the RED/WHT/BLK wire to S201 lug 2 (S-1). Be sure this wire is the one coming from S201/2 on the receiver board. Connect the WHT wire to S201 lug 1 (S-1).

## **FINAL WIRING**

- ( ) To perform this step, it may be easier to remove the filter switch from the front panel to make room for the wire connections on R124. Connect the BLK wire coming from the oscillator board to R124 lug 1 (S-1). Connect the GRN/BLK/WHT wire to R124 lug 2 (S-1). Connect the BLK/WHT wire to R124 lug 3 (S-1).
- ( ) If you are not installing the keyer kit at this time, proceed to the next step. If you are installing the keyer kit at this time, proceed to the instructions supplied with the keyer kit. After completing assembly of the keyer kit, proceed to the next step.

## **FINAL ASSEMBLY**

- ( ) Dress all wires and cables on the top side of the chassis as neat as possible. Use the supplied cable ties to bundle and tie the wires and cables together. The main bundle should end up about 2 to 2 1/2" above the chassis and above the space between the receiver and oscillator boards.
- ( ) Turn the radio over. Again dress the wires as neat as possible. Use several cable ties to secure the wires. The main bundle should end up about 1" above the T/R board and in line with the row of relays starting with K308 and ending with K302.
- ( ) Refer to Fig 10 for this step. Place the brass dial mount hub on your work table as shown. Slide the plastic dial pointer onto the small collar and line up the holes. Start a 2-56 x 1/8" screw in each hole. Tighten the screws a little past finger tight. Slide the dial assembly onto the shaft of the air variable cap. The larger hub goes toward the cap frame. The heads on the 2-56 screws are facing out. Turn the shaft all the way to the left. Rotate the dial until it lines up with the "0" mark. The inside of the plastic dial should just clear the outside of the front panel without rubbing. Now tighten the hex set screw. Place the large knob on the shaft. Be sure the knob set screw will end up on the outer or first section of the two section shaft. Tighten set screw. Turn the knob from "0" to "150". There should not be any binding. If there is binding, adjust accordingly.
- ( ) Turn the AF GAIN control shaft to the left until it clicks. Place a small knob on the shaft and line up the white line with the off mark. Tighten set screw.

## **FINAL ASSEMBLY**

- ( ) Turn the SPEED control shaft all the way to the right. Place a small knob on the shaft and line up the white line with the last mark on the right. Tighten set screw.
- ( ) Turn the RF GAIN control shaft all the way to the right. Place a small knob on the shaft and line up the white line with the max mark. Tighten set screw.
- ( ) Turn the band switch shaft all the way to the left. Place a small knob on the shaft and line up the white line with the 80 mark. Tighten set screw.
- ( ) Turn the RIT control shaft to the center detent position. Place a small knob on the shaft and line up the white line with the center mark. Tighten set screw.
- ( ) There may be a protective film on the silver inlay portion of the knobs. Use the pointed end of a hobby knife to carefully remove this film.

## **ALIGNMENT**

- ( ) You will need the following equipment to align your radio: 25 MHz oscilloscope with a 10:1 probe; 25 MHz frequency counter with a 10:1 probe; voltmeter; QRP wattmeter; QRP dummy load; your main station transceiver; a well filtered, well regulated power supply capable of supplying at least 1.75A at 13.6VDC. **DO NOT USE A PLUG IN THE WALL TYPE POWER SUPPLY!**
- ( ) If you do not have the proper test equipment or just don't want to do the alignment yourself, you can return your completed radio to us for alignment. The fee for this service is \$60.00 plus \$5.50 return shipping. This fee is for alignment only on properly assembled radios. The radio must be completely assembled. **PAYMENT MUST ACCOMPANY UNIT.**

## **ALIGNMENT**

- ( ) **Locate the molded power cable assembly. Place one lead of your ohmmeter in the center hole of the connector. Connect the other lead to the tinned end that gives you a zero ohms reading. Label this lead as POSITIVE. When you connect the cable to your power supply, be sure this lead goes to the POSITIVE terminal on your power supply. NOTE: If the positive terminal of your power supply is not fuse protected, you should install an in-line fuse holder with a 1.75A fuse in the positive lead of the power cable assembly.**
- ( ) **Preset the controls on the radio as follows: AF Gain - off; RIT - center detent; FILTER - out; SPEED - full clockwise; TUNE/OPER - operate; AGC - off; RF GAIN - full clockwise; BAND - 20M; MAIN TUNE - 75. On the rear panel, set the power adjust control shaft to about mid-range.**
- ( ) **Attach the molded power cable to the power connector on the rear panel. Turn on the power supply and radio. The RED led on the front panel should be lit.**
- ( ) **Attach your frequency counter probe (in X10 position) to "LOOP 1" on the oscillator board. Attach the probe ground lead to the side panel. Loop 1 is just forward of the IC. Be sure to use a X10 probe for this measurement. DO NOT use a piece of wire or clip lead as a probe. Attach a QRP wattmeter to the antenna connector. Terminate the wattmeter with a 5W dummy load.**
- ( ) **Adjust trim cap C153 for a frequency of 18.000 Mhz. Rotate the band switch to 30M and adjust trim cap C155 for a frequency of 14.000 Mhz.**
- ( ) **Rotate the band switch to 40M. Adjust trim cap C156 for a frequency of 11.000 Mhz.**
- ( ) **Rotate the band switch to 80M. Adjust trim cap C157 for a frequency of 7.500 Mhz.**
- ( ) **Rotate the band switch from 80M through 20M several times. All four crystals should start reliably each time.**

## **ALIGNMENT**

- ( ) **Connect your counter probe (in X10 position) to “LOOP 2”. This loop is located at the upper left corner of the board. Rotate the band switch to 20M. Rotate the main tuning dial to “0”. Adjust coil L104 for a frequency of 23.000 Mhz. This is the only adjustment necessary to set the VFO. The VFO will provide approximately 150 KHz of coverage on each band. You may have a slight under or overshoot at the top end of each band. This is normal.**
- ( ) **In the following steps you will adjust coils L102 & L103; L106 & L107; L108 & L109; L110 & L111. When you have completed these coil adjustments, the core of each coil should end up inside the coil without any part of the core protruding out the top. Attach your oscilloscope probe (in X10 position) to “LOOP 2”. Set the main tuning dial to “75”. Adjust coils L102 and L103 for a peak signal at 23.075 Mhz. Use the supplied alignment tool.**
- ( ) **Rotate the band switch to 30M. Adjust coils L106 & L107 for a peak signal at 19.075 Mhz.**
- ( ) **Rotate the band switch to 40M. Adjust coils L108 & L109 for a peak signal at 16.075 Mhz.**
- ( ) **Rotate the band switch to 80M. Adjust coils L110 & L111 for a peak signal at 12.575 Mhz.**
- ( ) **The signals at “LOOP 2” should be about .7V peak to peak using a X10 probe. The signal may appear rather jagged depending on the bandwidth of your scope. This is normal.**
- ( ) **Place the band switch in the 20M position. Attach your counter probe to “LOOP 2”. Be sure the RIT control is in its center detent position. Record the frequency. Place the tune/operate switch in the tune position and observe the frequency. Carefully adjust trim pot R127 so the frequency in the tune position is exactly the same as the frequency in the operate position. Keep toggling back and forth until both frequencies are exactly the same. Remove the probe from loop 2.**



## **ALIGNMENT**

- ( ) Attach the positive lead of your voltmeter to the bare lead of resistor R224 on the receiver board. R224 is located just below the MC1350P IC. Attach the ground lead of the voltmeter to the side panel. Be sure the RF GAIN control is at the MAX position. Adjust trim pot R234 for a voltage of 5.00VDC.**
- ( ) Turn the radio over so the T/R board is facing up. As you perform the following step, do not leave the radio in the tune position for more than 30 seconds at a time. Allow one minute for cool off.**
- ( ) Turn the power adjust control on the rear panel full counterclockwise as viewed from the rear panel. Place the tune/operate switch in the tune position. Adjust coils L303 & L304 on the T/R board for maximum output power on the wattmeter. Turn the main tuning dial from "0" to "150" while observing the wattmeter. The power output should be relatively even across the entire band. If it is not, continue adjusting L303 & L304 until it is. These two coil adjustments will interact, but you should be able to find a setting that will provide relatively even output power. You should have 4 - 5 watts of output. Unkey the radio.**
- ( ) Place the band switch in the 30M position. Repeat the above procedure, but this time adjust coils L312 & L313. Turn the power adjust control to keep the power output at 5 watts.**
- ( ) Place the band switch in the 40M position. Repeat the procedure, but this time adjust coils L319 & L320. Keep the power output at 5 watts.**
- ( ) Place the band switch in the 80M position. Repeat the procedure, but this time adjust coils L326 & L327. Keep the power output at 5 watts.**
- ( ) Turn the radio over so the receiver and oscillator boards are facing up. Place the filter switch to the "IN" position. Attach a 50 ohm antenna to the antenna jack. Attach 8 ohm headphones to the phones jack. Set the band switch to the band of your choice. Tune in a CW signal near the center of the dial. Adjust C233 on the receiver board for a 600 or 700 Hz CW note. You may have to make minor adjustments to the main tuning dial while adjusting C233. As you adjust C233, the CW signal will get louder as you center the signal in the audio filter.**

## **ALIGNMENT**

- ( ) You will find a setting where the CW note is loudest and at the correct frequency. Verify that C233 is adjusted on the lower side of the crystal filter skirt. This is easy to check. Tune in a CW signal. As you slowly turn the main tuning dial toward “0”, the CW signal should get lower and lower in frequency until you reach zero beat. If the signal goes higher and higher in frequency, this means you have adjusted C233 on the wrong side of the crystal filter skirt. Simply readjust C233 to the correct side.**
- ( ) Turn the radio over so the T/R board is up. In this step you will adjust the transmitter carrier oscillator. Attach a 50 ohm dummy load to the antenna jack. Set the main tuning dial to mid-range. If you have another transceiver or access to one, it will be very helpful for this adjustment. This really is the only accurate way to set the carrier oscillator. Terminate your other transceiver in its own 50 ohm dummy load. Transmit with the other transceiver into its dummy load and find the signal on the OHR 400. Tune the OHR 400 for the loudest signal. Unkey the other transceiver. Now, without touching the main tuning dial on either radio, place the tune/operate switch in the tune position. While listening for the QRP signal in the other transceiver, adjust C386 on the T/R board until you hear a nice mellow tone in the other transceiver. Do not leave the tune switch on for more than 30 seconds at a time.**
- ( ) Key the radio with the tune switch and adjust R219 on the receiver board for a comfortable sidetone level. Unkey the radio.**
- ( ) If you have installed the keyer kit, plug in your Iambic key. Key the radio using the keyer and adjust the weight pot, R2 to mid-range or to a setting of your choice.**
- ( ) Attach the top and bottom cabinet covers using the #8 x 1/2” black self-tapping screws. Install the four rubber feet on the bottom cover. Position the feet 1/2” in from each corner.**

## **OPERATION**

The operation of the OHR 400 is easy and straightforward. Simply attach a good power supply, 50 ohm antenna, your favorite key and a pair of 8 ohm headphones. With a good antenna system, stations worldwide can be routinely worked.

The RIT control will vary the receiver frequency  $\pm 1$  KHz. The RIT is defeated on transmit. Leave it in the center detent position when not in use.

The TUNE/OPERATE switch is used to manually key the transmitter to make transmatch adjustments.

The AGC switch is used to turn the agc circuit on and off. With the agc circuit turned off, the gain of the receiver can be manually controlled with the RF GAIN control. Maximum receiver gain occurs with the RF GAIN control fully clockwise.

The keyer speed control adjust the CW code speed on transmit. The speed is minimum with the knob clockwise. The speed pot is an audio taper type and is wired this way to make the speed adjustment more linear.

The power adjust control on the rear panel is used to adjust transmitter power output from 0 to full output. The most efficient operation occurs when the output power is 4.5 watts and the unit is drawing about 1.3A from the power supply.

The "OSC OUT" jack on the rear panel provides the LO signal for use with a frequency counter or dial display unit. The signal at this jack will indicate the receiver frequency within 700 Hz.

The audio circuit in the OHR 400 is designed for 8 ohm headphone operation. To obtain the best possible receiver audio performance, a good quality pair of 8 ohm communication headphones must be used. DO NOT use stereo or high impedance type headphones as this will significantly degrade the audio quality.

We hope you have enjoyed building the OHR 400, and that it provides you with many years of trouble free service. As always, we appreciate any comments or suggestions you may have.

**OAK HILLS RESEARCH**

# Oak Hills Research

## OHR 400 Parts List

### 40-180 Oscillator Board

QTY	OHR P/N	DESCRIPTION	DESIGNATOR	MARKINGS	PART ID
1	78L09	9V Regulator	U101	78L09	A9
1	NE602AN	8 Pin IC	U100	NE602AN	A12
1	MPP102	J-FET	Q101	MPP102	A9
1	J310	J-FET	Q100	J310	A9
3	2N3904	NPN Transistor	Q102,Q103,Q105	2N3904	A9
1	2N3906	PNP Transistor	Q104	2N3906	A9
1	ICS01	8 Pin IC Socket			A13
1"	K134	Large Red Wire			

# Oak Hills Research

## OHR 400 Parts List

### 40-180 Oscillator Board

QTY	OHR P/N	DESCRIPTION	DESIGNATOR	MARKINGS	PART ID
1	MC04	3.3pF NP0 Mono Cap	C105	339	A2
2	NP02	5pF NP0 Disc Cap	C136,C161	5	A3
1	MC08	6.8pF NP0 Mono Cap	C144	689	A2
2	K269	10pF Disc Cap	C116,C118	10	A3
3	MC14	22pF NP0 Mono Cap	C124,C125,C127	220	A2
1	K400	27pF N330 TC Mono Cap	C134	270 in separate	A2
1	K401	15pF N150 TC Mono Cap	C134	150 bag	A2
4	K271	22pF Disc Cap	C106,C107,C137, C160	22	A3
2	K254	62pF Disc Cap	C140,C141	62	A3
3	NP09	33pF Disc Cap	C145,C146,C162	33	A3
2	K270	47pF Disc Cap	C121,C122	47	A3
1	K275	100pF Disc Cap	C131	100	A3
2	MC26	220pF NP0 Mono Cap	C126, C129	221	A2
1	MC22	100pF NP0 Mono Cap	C147	101	A2
1	MC25	180pF NP0 Mono Cap	C151	181	A2
2	MC32	680pF NP0 Mono Cap	C114,C119	681	A2
4	TC13	120pF PC Trim Cap	C153,C155,C156, C157	BLACK Case	A4
14	CD17	.01μF Disc Cap	C109,C110,C113, C115,C117,C120, C123,C130,C133, C138,C139,C142, C148,C154	103	A3

# Oak Hills Research

## OHR 400 Parts List

### 40-180 Oscillator Board

QTY	OHR P/N	DESCRIPTION	DESIGNATOR	MARKINGS	PART ID
1	6-150-14	15 Ohm 1/4W 5% Resistor	R122	BRN-GRN-BLK-GLD	
2	6-470-14	47 Ohm 1/4W 5% Resistor	R103,R139	YEL-VIO-BLK-GLD	
3	6-101-14	100 Ohm 1/4W 5% Resistor	R102,R105,R114	BRN-BLK-BRN-GLD	
1	6-271-14	270 Ohm 1/4W 5% Resistor	R118	RED-VIO-BRN-GLD	
3	6-471-14	470 Ohm 1/4W 5% Resistor	R112,R133,R145	YEL-VIO-BRN-GLD	
2	6-561-14	560 Ohm 1/4W 5% Resistor	R119,R125	GRN-BLU-BRN-GLD	
1	6-102-14	1K Ohm 1/4W 5% Resistor	R117	BRN-BLK-RED-GLD	
5	6-222-14	2.2K Ohm 1/4W 5% Resistor	R104,R107,R128, R147,R148	RED-RED-RED-GLD	
4	6-332-14	3.3K Ohm 1/4W 5% Resistor	R101,R113,R123, R129	ORG-ORG-RED-GLD	
5	6-472-14	4.7K Ohm 1/4W 5% Resistor	R140,R141,R142, R143,R146	YEL-VIO-RED-GLD	
1	6-512-14	5.1K Ohm 1/4W 5% Resistor	R132	GRN-BRN-RED-GLD	
2	6-103-14	10K Ohm 1/4W 5% Resistor	R126,R144	BRN-BLK-ORG-GLD	
1	POT7	10K Ohm PC Trim Pot	R127	103	A1
1	6-123-14	12K Ohm 1/4W 5% Resistor	R108	BRN-RED-ORG-GLD	
1	6-153-14	15K Ohm 1/4W 5% Resistor	R115	BRN-GRN-ORG-GLD	
1	6-223-14	22K Ohm 1/4W 5% Resistor	R110	RED-RED-ORG-GLD	
3	6-104-14	100K Ohm 1/4W 5% Resistor	R106,R109,R121	BRN-BLK-YEL-GLD	
2	6-334-14	330K Ohm 1/4W 5% Resistor	R130,R131	ORG-ORG-YEL-GLD	
1	6-105-14	1M Ohm 1/4W 5% Resistor	R120	BRN-BLK-GRN-GLD	

# Oak Hills Research

## OHR 400 Parts List

### 40-180 Oscillator Board

QTY	OHR P/N	DESCRIPTION	DESIGNATOR	MARKINGS	PART ID
10	MC102	.1μF Mono Cap	C108,C111,C112, C128,C132,C143, C149,C152,C158, C159	104	A2
2	CH07	1.5μH Choke	L117, L118	BRN-GRN-GLD	A5
1	CH11	4.7μH Choke	L119	YEL-VIO-GLD	A5
1	CH14	10μH Choke	L120	BRN-BLK-BLK	A5
1	CH26	100μH Choke	L105	BRN-BLK-BRN	A5
6	K242	1.2μH Coil	L102,L103,L106, L107,L108,L109	RED Base	A6
2	K303	3.3μH Coil	L110,L111	GREEN Base	A6
1	K304	12μH Coil	L104	GREY Base	A6
1	K154	7.5 Mhz Crystal	Y104	HC-49 Case	C2
1	K018	11 Mhz Crystal	Y103	HC-49 Case	C2
1	K306	14.000 Mhz Crystal	Y102	HC-49 Case	C2
1	K248	18 Mhz Crystal	Y101	HC-49 Case	C2
1	K235	Bifilar Pre-wound Coil	T100		A7
10	1N4148	Silicon Diode	D102,D103,D104, D105,D106,D107, D108,D110,D111, D112	1N4148	A10
4	MPN3404	Pin Diode	D115,D116,D117, D118	MPN3404	A11
1	MV2109	Varactor Diode	D109	MV2109	A11

# Oak Hills Research

## OHR 400 Parts List

### 40-177 Receiver Board

QTY	OHR P/N	DESCRIPTION	DESIGNATOR	MARKINGS	PART ID
1	6-273-14	27K Ohm 1/4W 5% Resistor	R231	RED-VIO-ORG-GLD	
9	6-333-14	33K Ohm 1/4W 5% Resistor	R226,R227,R228, R239,R240,R245, R247,R248,R250	ORG-ORG-ORG- GLD	
2	6-104-14	100K Ohm 1/4W 5% Resistor	R218,R236	BRN-BLK-YEL-GLD	
1	6-394-14	390K Ohm 1/4W 5% Resistor	R230	ORG-WHT-YEL-GLD	
1	6-105-14	1M Ohm 1/4W 5% Resistor	R243	BRN-BLK-GRN-GLD	
1	MC24	150pF NP0 Mono Cap	C239	151J	A2
2	MC28	330pF NP0 Mono Cap	C202,C205	331	A2
2	MC30	470pF NP0 Mono Cap	C203,C206	471	A2
1	MC31	560pF NP0 Mono Cap	C204	561	A2
1	MC100	.001μF Mono Cap	C213	102	A2
9	MC101	.01μF Mono Cap	C200,C201,C207, C208,C209,C210, C211,C214,C228	103	A2
3	K112	.01μF Polyester Cap	C224,C225,C226	103 (Green Body)	B1
1	K108	.022μF Polyester Cap	C219	223 (Green Body)	B1
1	K109	.033μF Polyester Cap	C230	333 (Green Body)	B1
3	K016	.0022μF Polyester Cap	C223,C235,C236	222 (Green Body)	B1
9	MC102	.1μF Mono Cap	C212,C220,C221, C222,C229,C237, C240,C241,C242	104	A2



# Oak Hills Research

## OHR 400 Parts List

### 40-177 Receiver Board

QTY	OHR P/N	DESCRIPTION	DESIGNATOR	MARKINGS	PART ID
1	6-279-14	2.7 Ohm 1/4W 5% Resistor	R220	RED-VIO-GLD-GLD	
1	6-569-14	5.6 Ohm 1/4W 5% Resistor	R200	GRN-BLU-GLD-GLD	
2	6-330-14	33 Ohm 1/4W 5% Resistor	R201,R204	ORG-ORG-BLK-GLD	
3	6-470-14	47 Ohm 1/4W 5% Resistor	R210,R212,R215	YEL-VIO-BLK-GLD	
1	6-560-14	56 Ohm 1/4W 5% Resistor	R202	GRN-BLU-BLK-GLD	
1	6-680-14	68 Ohm 1/4W 5% Resistor	R206	BLU-GRY-BLK-GLD	
1	6-101-14	100 Ohm 1/4W 5% Resistor	R237	BRN-BLK-BRN-GLD	
2	6-271-14	270 Ohm 1/4W 5% Resistor	R208,R209	RED-VIO-BRN-GLD	
3	6-471-14	470 Ohm 1/4W 5% Resistor	R211,R213,R216	YEL-VIO-BRN-GLD	
1	6-561-14	560 Ohm 1/4W 5% Resistor	R203	GRN-BLU-BRN-GLD	
6	6-102-14	1K Ohm 1/4W 5% Resistor	R205,R214,R217, R244,R252,R251	BRN-BLK-RED-GLD	
3	6-222-14	2.2K Ohm 1/4W 5% Resistor	R225,R238,R254*	RED-RED-RED-GLD	
1	6-472-14	4.7K Ohm 1/4W 5% Resistor	R232	YEL-VIO-RED-GLD	
1	6-682-14	6.8K Ohm 1/4W 5% Resistor	R207	BLU-GRY-RED-GLD	
7	6-103-14	10K Ohm 1/4W 5% Resistor	R221,R222,R224, R229,R233,R235, R241	BRN-BLK-ORG-GLD	
2	POT7	10K Ohm PC Trim Pot	R219,R234	103	A1
1	6-153-14	15K Ohm 1/4W 5% Resistor	R246	BRN-GRN-ORG-GLD	
2	6-223-14	22K Ohm 1/4W 5% Resistor	R249,R253	RED-RED-ORG-GLD	

\* NOTE: Resistor R254 will be installed during final wiring.

# Oak Hills Research

## OHR 400 Parts List

### 40-177 Receiver Board

QTY	OHR P/N	DESCRIPTION	DESIGNATOR	MARKINGS	PART ID
1	TC11	50pF PC Trim Cap	C233	Orange Case	A4
1	CE01	.47uF Electrolytic Cap	C217		B2
1	MC106	1uF Mono Cap	C231	105	A2
1	CE02	1uF Electrolytic Cap	C232		B2
1	CE06	10uF Electrolytic Cap	C227		B2
3	CE07	22uF Electrolytic Cap	C234,C238,C243		B2
2	CE10	100uF Electrolytic Cap	C215,C216		B2
1	CE11	220uF Electrolytic Cap	C218		B2
1	K235	Bifilar Pre-wound Coil	T200		A7
1	CH16	15uH Choke	L200*	BRN-GRN-BLK	A5
5	K032	9 Mhz Crystal	Y200,Y201,Y202, Y203,Y204		A8
1	1N5817	Schottky Diode	D201	1N5817	A10
2	1N4148	Silicon Diode	D200,D202	1N4148	A10
2	MPF102	J-FET	Q203,Q204	MPF102	A9
1	2N3866	NPN Transistor	Q200	2N3866	B3
1	2N3906	PNP Transistor	Q202	2N3906	A9
1	2N5770	NPN Transistor	Q201	2N5770	A9
1	LM358N	8 Pin IC	U202	LM358N	A12
1	LM380N-8	8 Pin IC	U201	LM380N-8	A12
1	MC1350P	8 Pin IC	U200	MC1350P	A12
1	NE602AN	8 Pin IC	U203	NE602AN	A12
1	NE5534N	8 Pin IC	U205	NE5534N	A12
2	TL082CPN	8 Pin IC	U204,U206	TL082CPN	A12
7	ICS01	8 Pin IC Socket			A13
1	K027	TO-39 Transistor Heat sink			B6
1	HS03	TO-39 Transistor Spacer			B5

\* Choke L200 is tack soldered on the bottom of the board

# Oak Hills Research

## OHR 400 Parts List

### 40-175 T/R Board

QTY	OHR P/N	DESCRIPTION	DESIGNATOR	MARKINGS	PART ID
6	K068	4.7µH Coil	L303,L304,L312, L313,L319,L320	T1005	A6
2	K125	8.2µH Coil	L326,L327	T1008	A6
1	K032	9 Mhz Crystal	Y300		A8
8	K298	Reed Relay	K302,K303,K304, K305,K306,K307, K308,K309	PRMA 1A 12	C10
20	1N4148	Silicon Diode	D302,D303,D304, D305,D306,D307, D308,D309,D310, D311,D312,D316, D318,D319,D320, D321,D322,D323, D324,D326	1N4148	A10
3	1N4007	Silicon Diode	D313,D314,D325*	1N4007	C9
1	MPF102	J-FET	Q311	MPF102	A9
1	2N2222A	NPN Transistor	Q302	2N2222A	C4
1	2N3053	NPN Transistor	Q307	2N3053	B3
1	2N3866	NPN Transistor	Q301	2N3866	B3
4	2N3904	NPN Transistor	Q303,Q308,Q309, Q310	2N3904	A9
2	2N3906	PNP Transistor	Q304,Q306	2N3906	A9
1	2N5179	NPN Transistor	Q305	2N5179	B4
1	2SC2075	NPN Transistor	Q300	2SC2075	C6
1	TUF-1	Diode Ring Mixer	U302	TUF-1	C11
2	K027	TO-39 Transistor Spacer			B5
1	HS03	TO-39 Transistor Heatsink			B6

\* Diode D325 is NOT board mounted

# Oak Hills Research

## OHR 400 Parts List

### 40-175 T/R Board

QTY	OHR P/N	DESCRIPTION	DESIGNATOR	MARKINGS	PART ID
1	6-473-14	47K Ohm 1/4W 5% Resistor	R330	YEL-VIO-ORG-GLD	
1	6-104-14	100K Ohm 1/4W 5% Resistor	R356	BRN-BLK-YEL-GLD	
1	MC01	1pF NP0 Mono Cap	C310	109	A2
2	MC04	3.3pF NP0 Mono Cap	C325,C342	339	A2
1	MC08	6.8pF NP0 Mono Cap	C351	689	A2
2	K269	10pF Cer Disc Cap	C366,C383	10	A3
2	K305	12pF Cer Disc Cap	C309,C311	12	A3
4	K299	15pF Cer Disc Cap	C313,C314,C324, C326	15	A3
1	NP05	18pF Cer Disc Cap	C381	18	A3
4	NP09	33pF Cer Disc Cap	C331,C332,C341, C343	33	A3
3	NP11	51pF Cer Disc Cap	C368,C384,C385	51	A3
2	K300	56pF Cer Disc Cap	C350,C352	56	A3
2	K301	68pF Cer Disc Cap	C344,C345	68	A3
2	K277	120pF Cer Disc Cap	C338,C339	120	A3
2	K284	180pF Cer Disc Cap	C356,C357	180	A3
2	K278	220pF Cer Disc Cap	C346,C347	220	A3
1	K283	270pF Cer Disc Cap	C340	270	A3
2	K273	330pF Cer Disc Cap	C353,C355	330	A3
1	K279	470pF Cer Disc Cap	C348	470	A3
3	K282	680pF Cer Disc Cap	C354,C361,C363	680	A3
1	K114	1200pF Poly Cap	C362	122	B1
2	MC100	.001uF Mono Cap	C321,C328	102	A2
1	TC13	120pF PC Trim Cap	C386	Black Body	A4

# Oak Hills Research

## OHR 400 Parts List

### 40-175 T/R Board

QTY	OHR P/N	DESCRIPTION	DESIGNATOR	MARKINGS	PART ID
1	6-129-14	1.2 Ohm 1/4W 5% Resistor	R311	BRN-RED-GLD-GLD	
2	6-339-14	3.3 Ohm 1/4W 5% Resistor	R302,R350	ORG-ORG-GLD-GLD	
2	6-100-14	10 Ohm 1/4W 5% Resistor	R318,R342	BRN-BLK-BLK-GLD	
1	6-270-14	27 Ohm 1/4W 5% Resistor	R303	RED-VIO-BLK-GLD	
2	6-470-14	47 Ohm 1/4W 5% Resistor	R308,R352	YEL-VIO-BLK-GLD	
1	6-820-14	82 Ohm 1/4W 5% Resistor	R319	GRY-RED-BLK-GLD	
5	6-101-14	100 Ohm 1/4W 5% Resistor	R324,R325,R332, R344,R355	BRN-BLK-BRN-GLD	
1	K228	100 Ohm Vert PC Pot w/shaft	R317	100 (Pink Body)	C1
3	6-471-14	470 Ohm 1/4W 5% Resistor	R340,R351,R357	YEL-VIO-BRN-GLD	
1	6-561-14	560 Ohm 1/4W 5% Resistor	R335	GRN-BLU-BRN-GLD	
1	6-681-14	680 Ohm 1/4W 5% Resistor	R329	BLU-GRY-BRN-GLD	
20	6-102-14	1K Ohm 1/4W 5% Resistor	R304,R305,R309, R310,R312,R313, R314,R315,R316, R320,R321,R322, R323,R334,R339, R341,R343,R345, R347,R349	BRN-BLK-RED-GLD	
1	6-152-14	1.5K Ohm 1/4W 5% Resistor	R353	BRN-GRN-RED-GLD	
1	6-222-14	2.2K Ohm 1/4W 5% Resistor	R336	RED-RED-RED-GLD	
2	6-332-14	3.3K Ohm 1/4W 5% Resistor	R333,R354	ORG-ORG-RED-GLD	
1	6-562-14	5.6K Ohm 1/4W 5% Resistor	R307	GRN-BLU-RED-GLD	
6	6-103-14	10K Ohm 1/4W 5% Resistor	R306,R326,R337, R338,R346,R348	BRN-BLK-ORG-GLD	
1	6-472-14	4.7K Ohm 1/4W 5% Resistor	R358 *	YEL-VIO-RED-GLD	

\* This 4.7K ohm resistor is NOT board mounted

# Oak Hills Research

## OHR 400 Parts List

### 40-175 T/R Board

QTY	OHR P/N	DESCRIPTION	DESIGNATOR	MARKINGS	PART ID
19	CD17	.01µF Cer Disc Cap	C317,C318,C320, C322,C323,C327, C329,C330,C336, C349,C359,C364, C369,C370,C371, C372,C373,C376, C377	103	A3
12	MC102	.1µF Mono Cap	C306,C312,C315, C316,C319,C337, C358,C365,C374, C380,C382,C387	104	A2
1	CE02	1µF Electrolytic Cap	C378		B2
1	CE06	10µF Electrolytic Cap	C375		B2
1	CE10	100µF Electrolytic Cap	C307		B2
1	CE11	220µF Electrolytic Cap	C379		B2
1	CH18	22µH Choke	L332	RED-RED-BLK	A5
9	CH26	100µH Choke	L305,L310,L311, L314,L325,L328, L329,L330,L331	BRN-BLK-BRN	A5
2	K039	Pre-wound Coil	L315,L316	Labeled Bag (20M)	C3
2	K043	Pre-wound Coil	L317,L318	Labeled Bag (30M)	C3
2	K044	Pre-wound Coil	L321,L322	Labeled Bag (40M)	C3
2	K045	Pre-wound Coil	L323,L324	Labeled Bag (80M)	C3
4	K235	Bifilar Pre-wound Coil	T300,T301,T302, T303		A7
1	IF01	Transformer	T304	42IF123	A6

# Oak Hills Research

## OHR 400 Parts List

### Chassis Parts

QTY	OHR P/N	DESCRIPTION	DESIGNATOR	MARKINGS	PART ID
10	K147	3/8" x 1/4" Round Alum Spacer			D11
4	K239	1/4" Hex Alum Spacer			D12
25	K162	4-40 x 1/4" Machine Screw			D6
9	K056	4-40 x 5/16" Machine Screw			D8
4	K238	4-40 x 5/8" Machine Screw			D7
50	K058	#4 Lockwasher			D14
15	K059	#4 Hex Nut			D15
2	K004	#4 Solder Lug			D13
8	K038	6-32 x 3/8" Machine Screw			D3
1	K117	6-32 x 5/8" Machine Screw			D4
8	K152	#8 x 1/2" Black Sheet Metal Screw			D23
10	K116	#6 Lockwasher			D5
10	K014	#6 Large Hex Nut			D1
2	K066	2-56 x 1/8" Machine Screw			D18
1	K006	Brass Dial Mounting Hub			D17
1	K165	Plastic Dial Pointer			D19
1	K294	Large Knob			E11
5	K296	Small Knob			E10
4	K132	Cabinet Feet			D20
8	K145	Plastic Tie			D21
1	K234	Molded Power Cable Assembly			F5
1	K241	Alignment Tool			D22
21"	K047	25 Conductor Cable			
53"	RG174/U	Miniature Coax Cable			

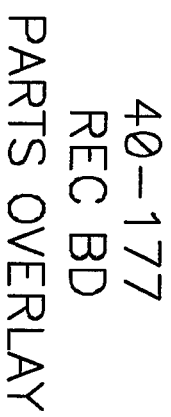
# Oak Hills Research

## OHR 400 Parts List

### Chassis Parts

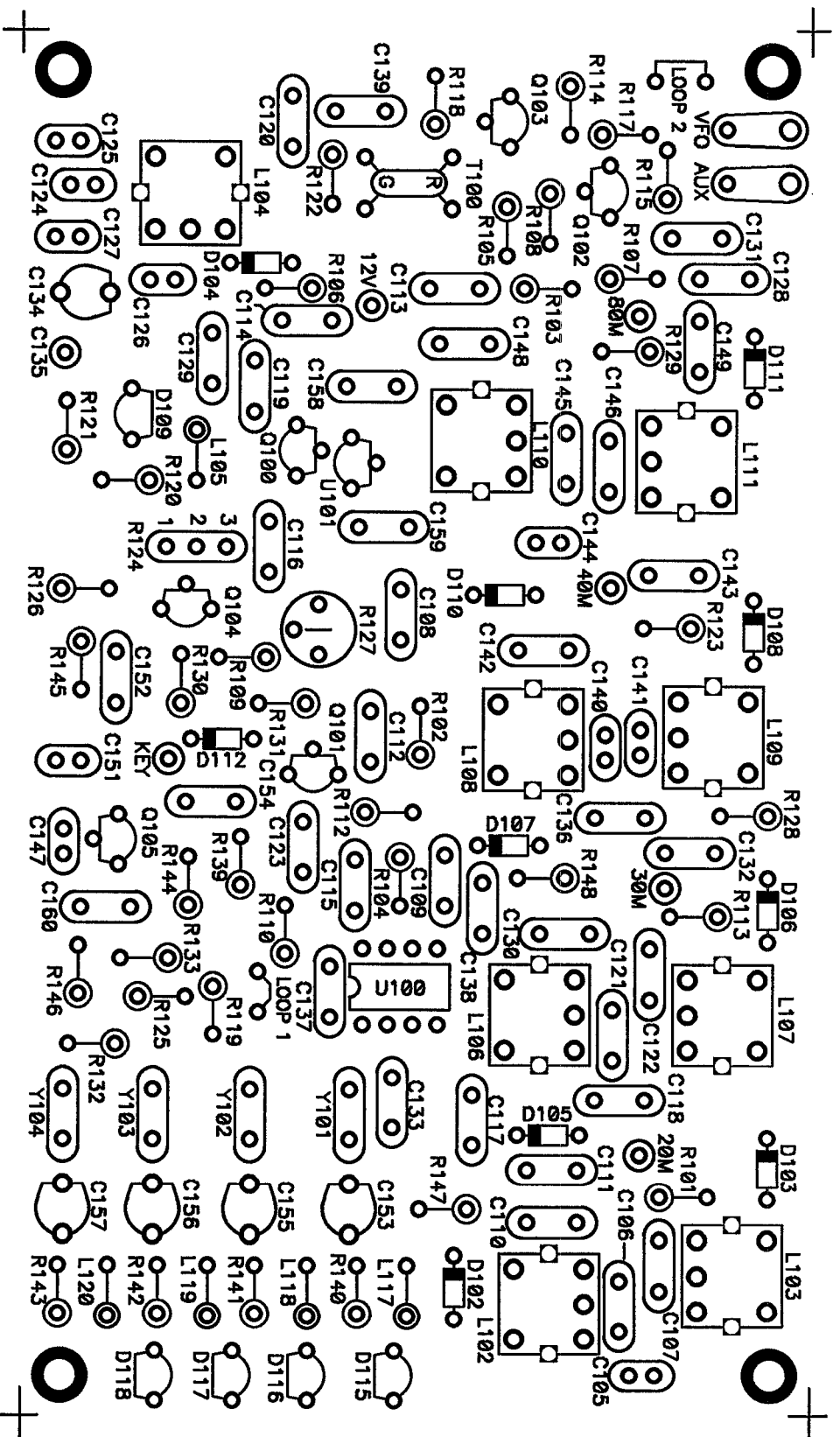
QTY	OHR P/N	DESCRIPTION	DESIGNATOR	MARKINGS	PART ID
1	40-177	Receiver PC Board		40-177	
1	40-175	T/R PC Board		40-175	
1	40-180	Oscillator PC Board		40-180	
2	10-108-A	Cabinet Cover			F4
1	10-108-B	Front Panel			
1	10-108-C	Rear Panel			
1	10-108-D	Chassis Panel			F2
2	10-108-E	Side Panels			F3
1	K092	SO-239 Antenna Connector	J300		E9
1	K098	Dual 1/4" Key Jack	Keyer Jack		E13
2	K090	Standard 1/4" Jack	J200,J301		E4
1	K293	Coaxial Power Jack	J302		E12
1	K	Panel Mount Phono Jack			E1
3	K237	4 Lug Terminal Strip	TB1,TB2,TB3		D9
1	AV03	18pF Air Variable Cap	C135	OHR-1	F1
1	K222	10K Panel Pot W/Switch	R257/S301	A10K	E3
1	K013	10K Center Detent Panel Pot	R124	B10K	E5
1	MP04	10K Panel Pot	R256	B10K	E5
1	K158	500K Panel Pot	Keyer Speed	A500K	E8
3	K095	SPDT Toggle Switch	S200,S201,S300		E7
1	K168	4 POS Rotary Switch	S302		E6
1	K263	RED LED W/Wire Leads	D327		E2
2	K017	1/2" Grommet			D16
1	TMK01	TO-220 Transistor Mt Hardware			
1	K012	Large Control Hex Nut		Used on S302	
8	K151	1/4" Square Nylon Nut			D2

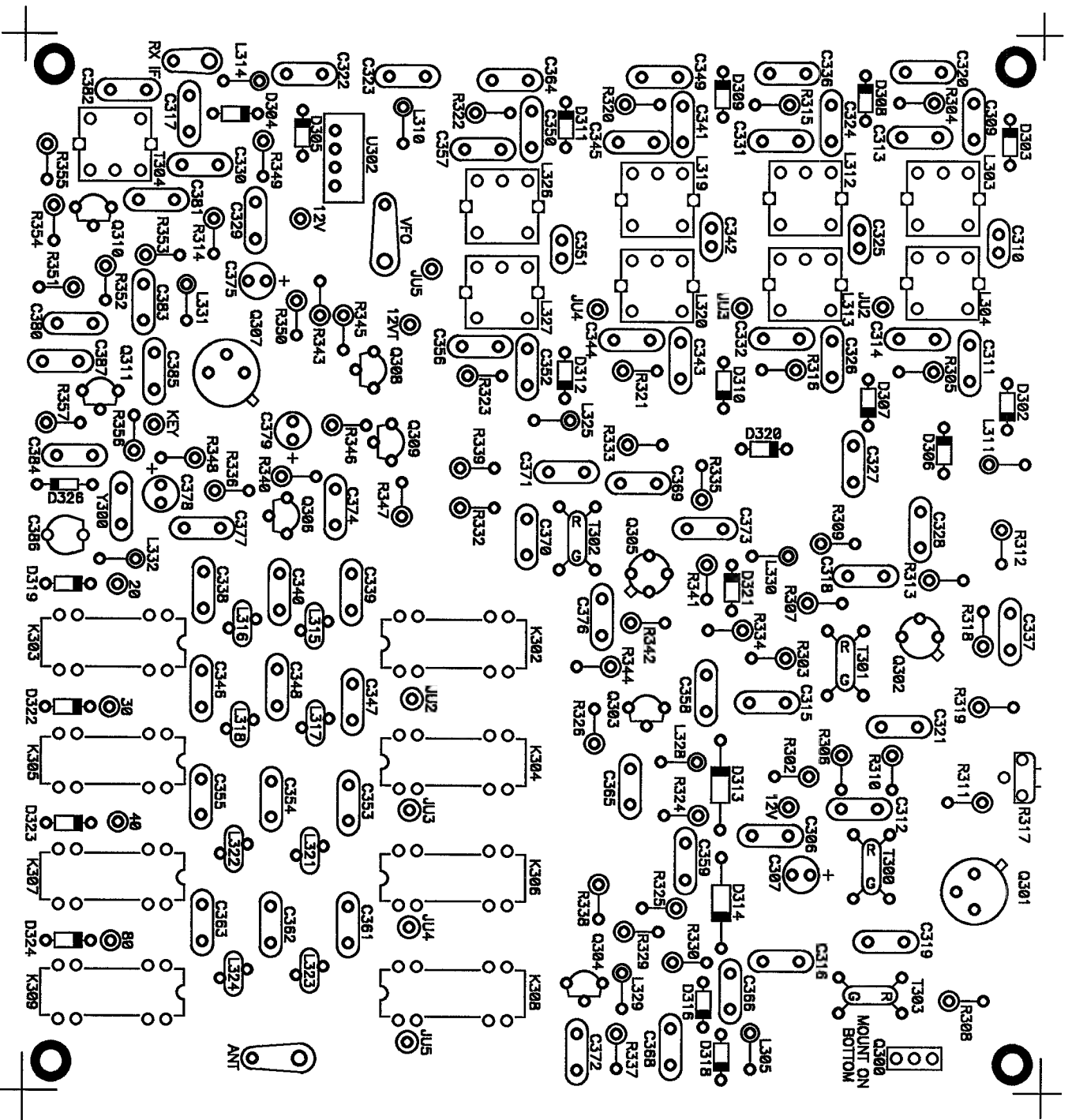




REC BD

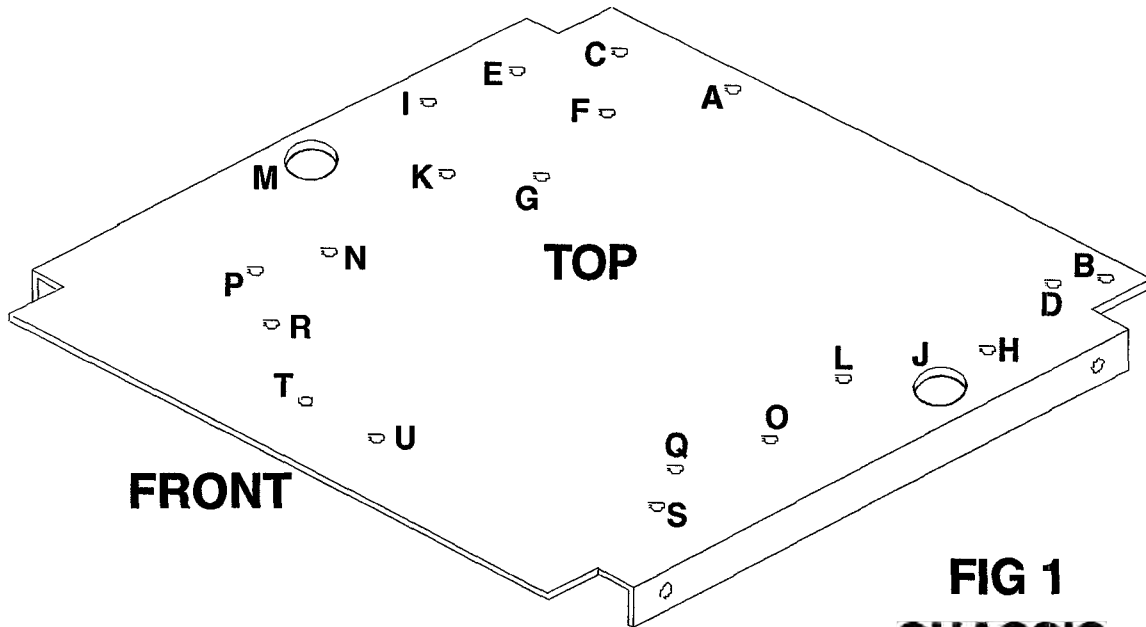
## PARTS OVERLAY



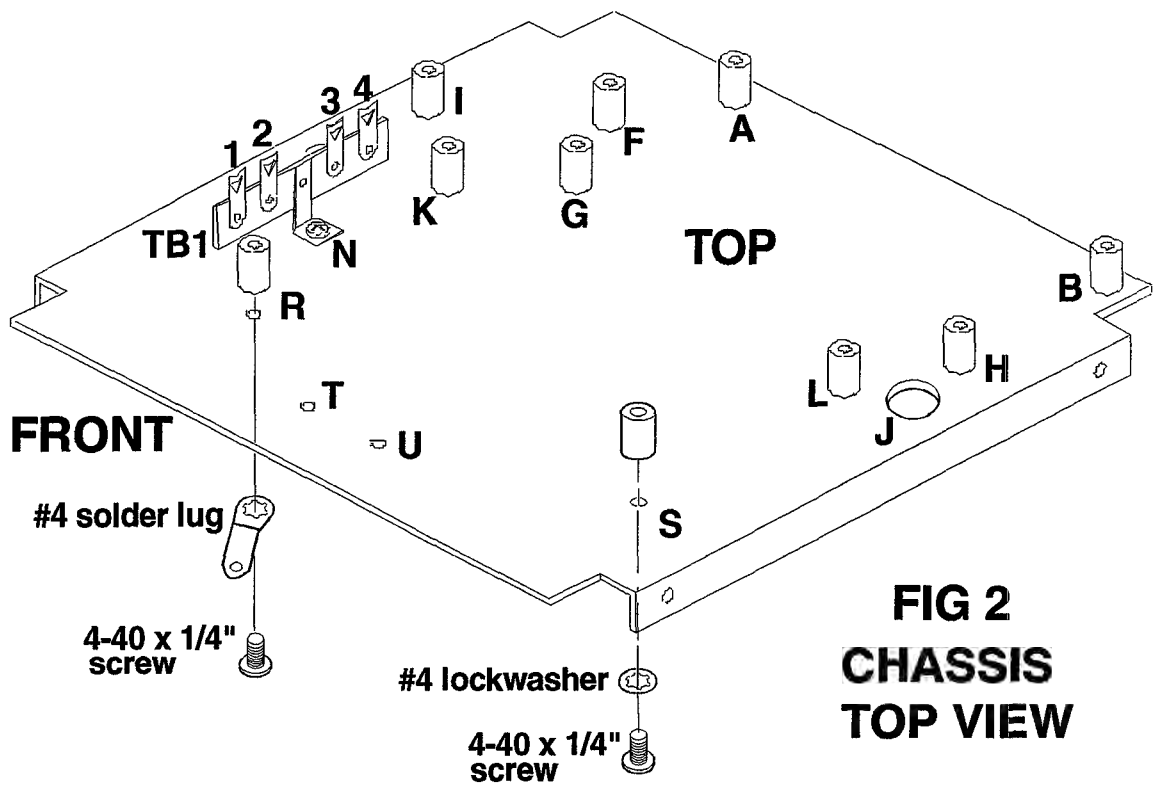


PARTS OVERLAY  
 T/R BOARD  
 40-175

# ASSEMBLY PICTORIAL

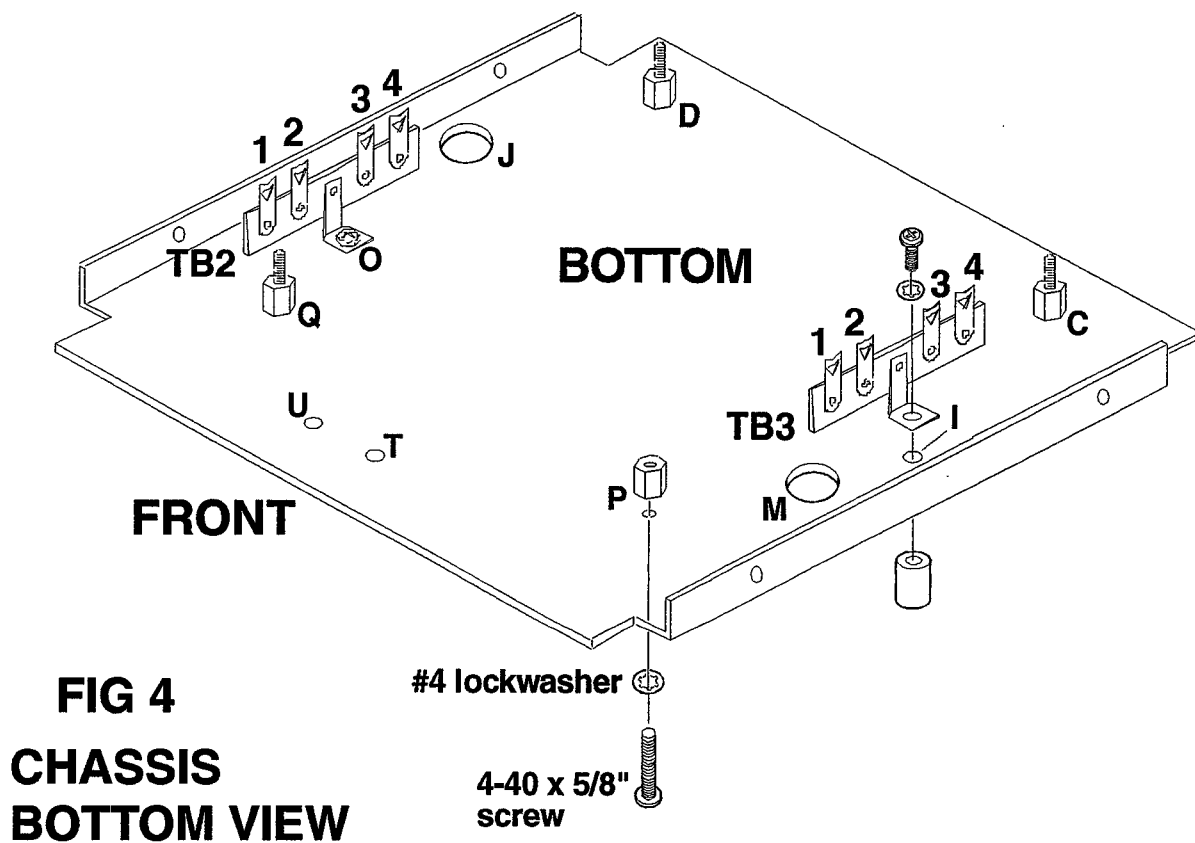
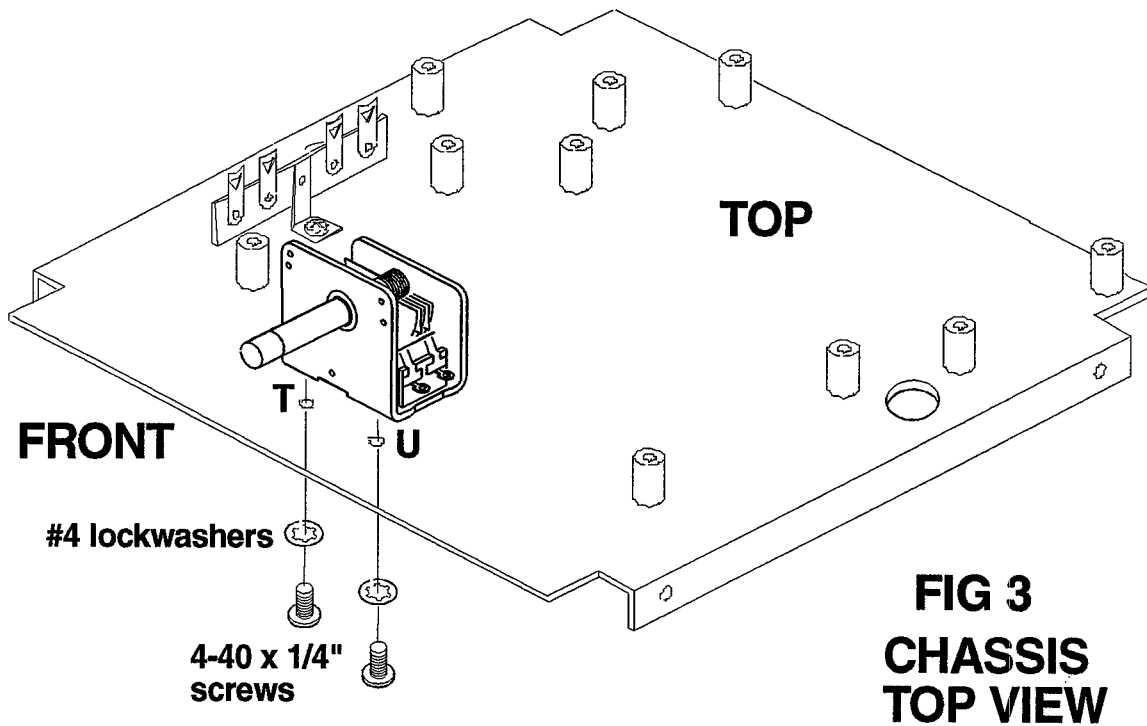


**FIG 1**  
**CHASSIS**  
**TOP VIEW**

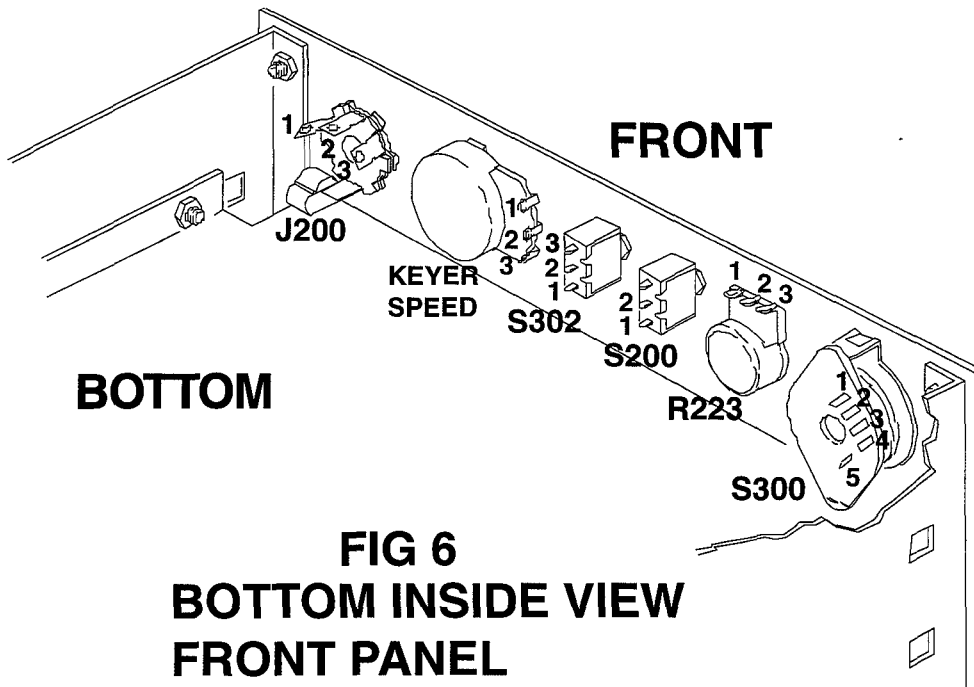
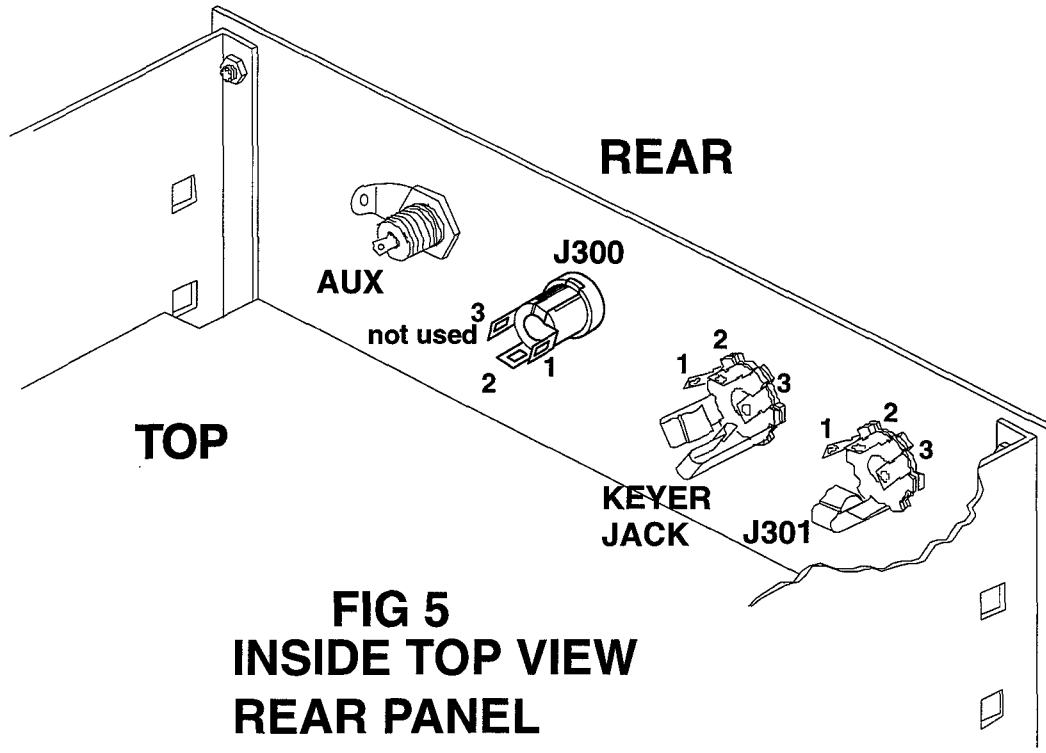


**FIG 2**  
**CHASSIS**  
**TOP VIEW**

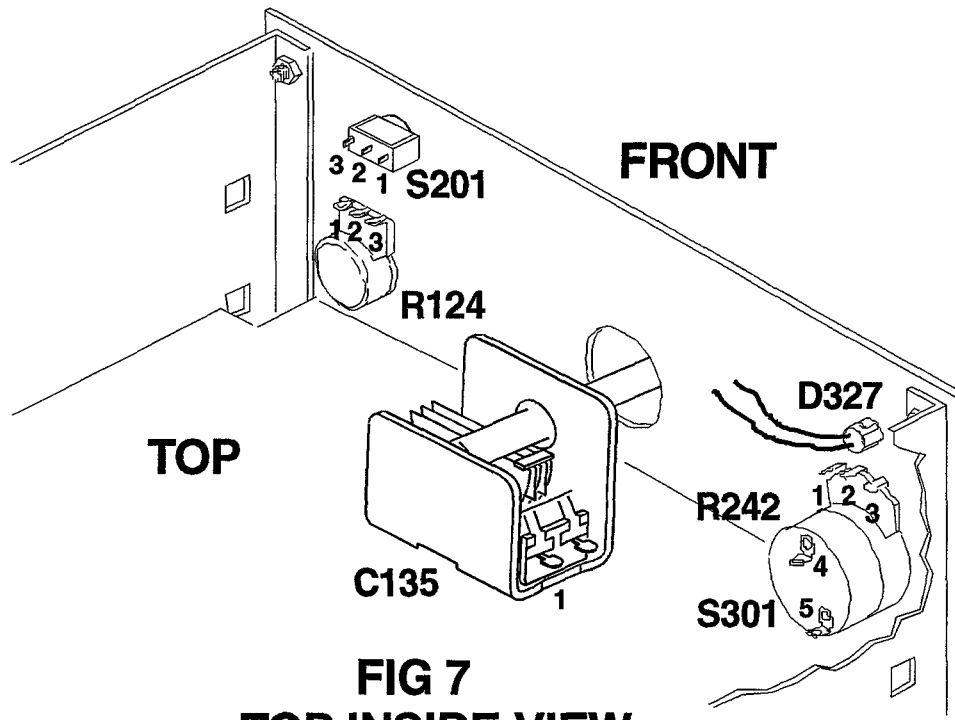
# ASSEMBLY PICTORIAL



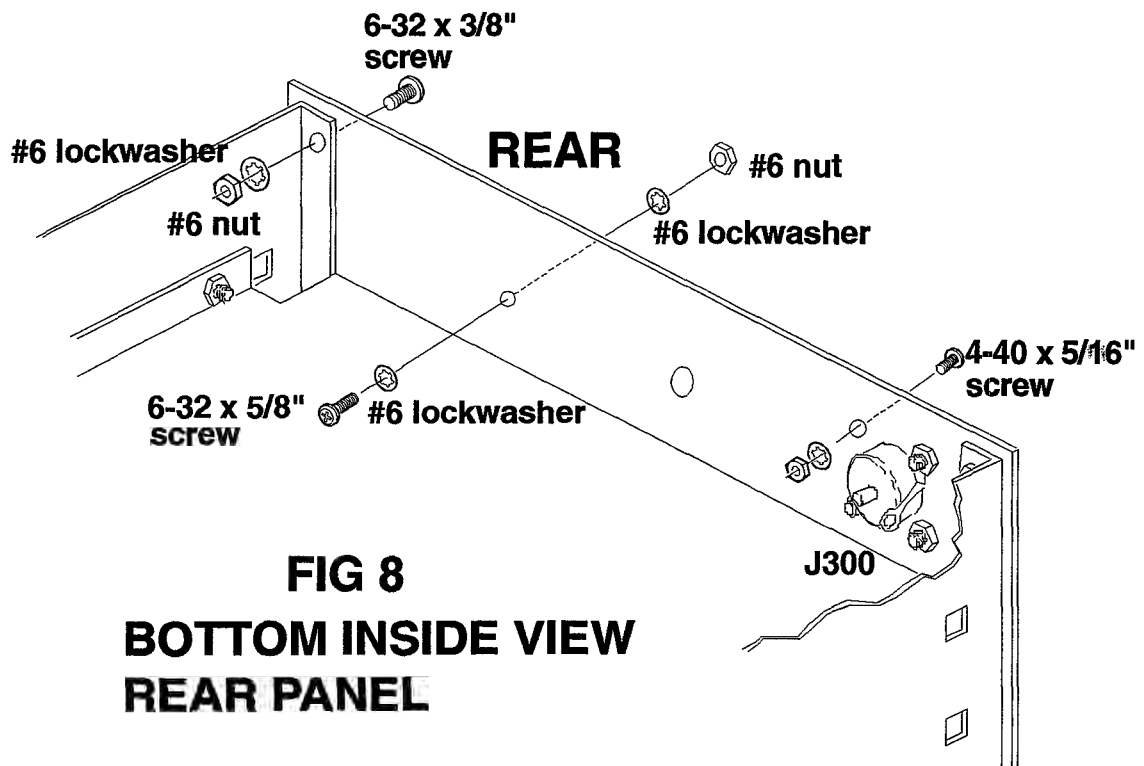
# ASSEMBLY PICTORIAL



# ASSEMBLY PICTORIAL

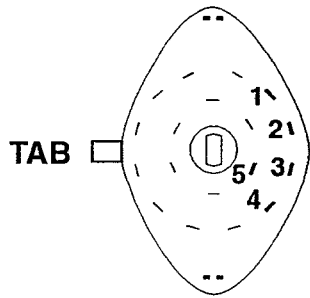


**FIG 7**  
**TOP INSIDE VIEW**  
**FRONT PANEL**



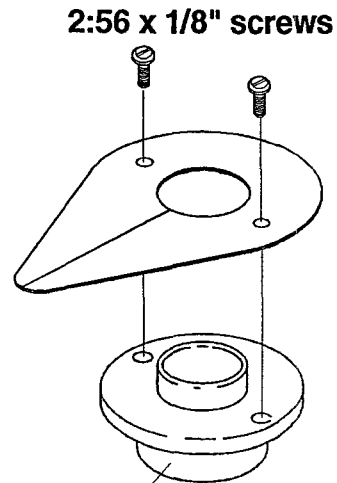
**FIG 8**  
**BOTTOM INSIDE VIEW**  
**REAR PANEL**

# ASSEMBLY PICTORIAL



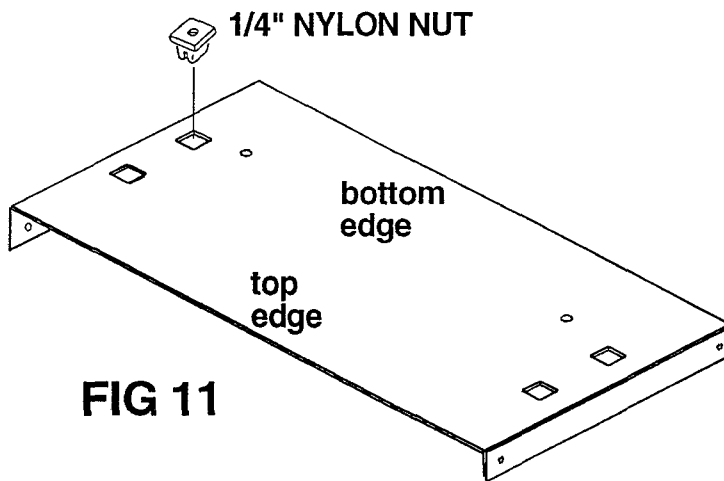
CUTOFF ALL UNMARKED PINS FLUSH WITH BACK OF SWITCH. DO NOT CUT OFF PINS 1, 2, 3, 4 & 5.

**FIG 9**  
**REAR VIEW**  
**S302**

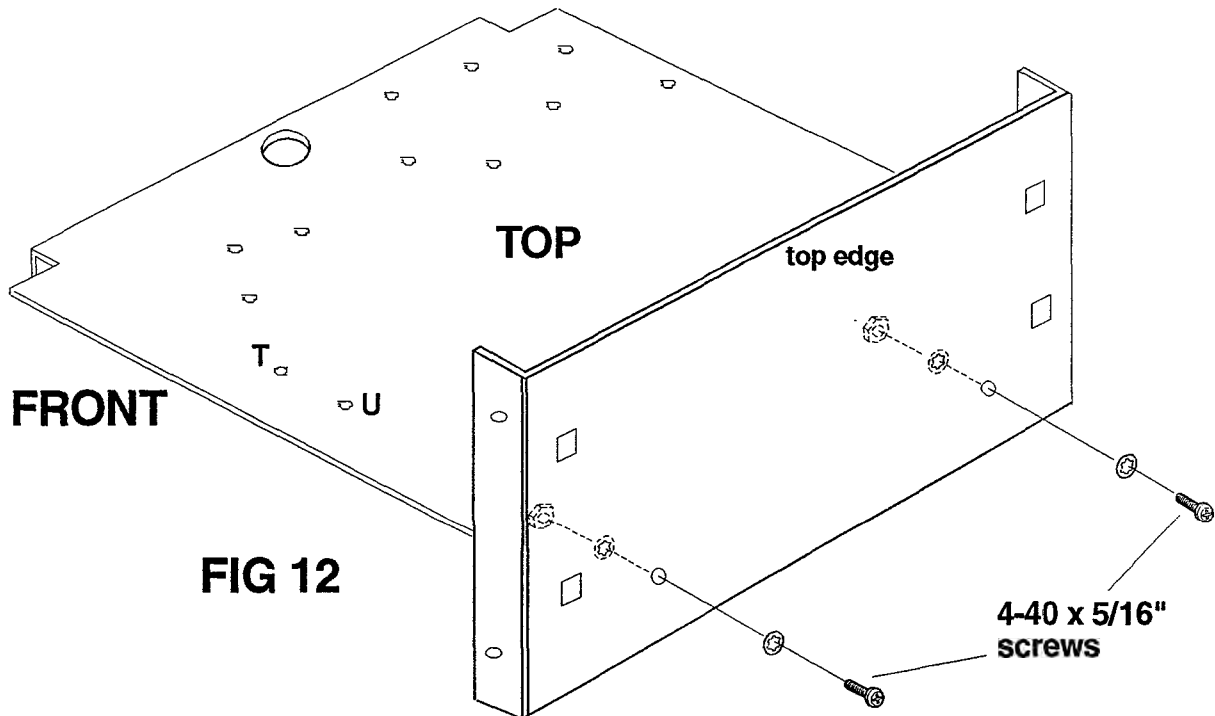


This larger hub end goes toward frame on air variable cap

**FIG 10**



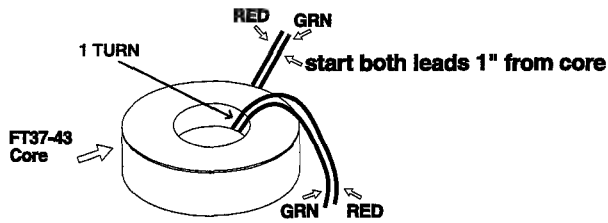
**FIG 11**



**FIG 12**

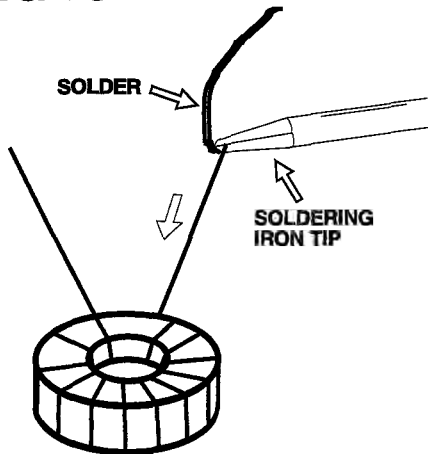


# ASSEMBLY PICTORIAL



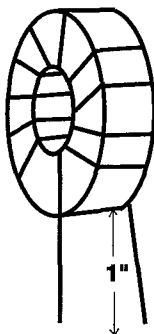
Everytime the wires pass through the center of the core, you count that as one turn. Turns are always counted on the inside of the core.

## FIG 13



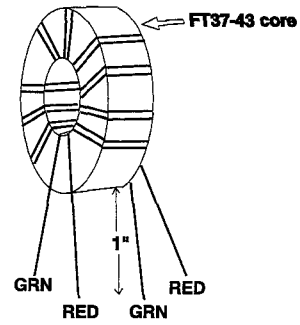
To tin the lead, place the soldering iron tip and solder on the lead near the end and feed a small amount of solder to the tip and lead. Move the tip back and forth a small amount. Keep feeding more solder to the tip and lead. The lead will start to tin. As it does, slowly move the tip and solder up the lead toward the core. As you do, the lead will become tinned. Continue until the entire lead is tinned. Repeat with the other lead or leads.

## FIG 15



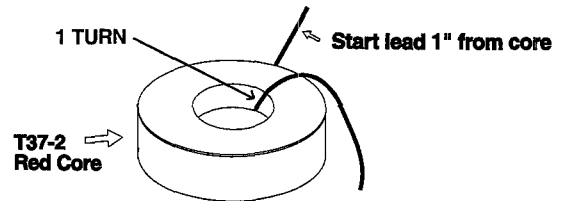
After winding, trim both leads to 1" from core  
Tin each lead to the core

## FIG 17



After winding, trim all four leads to 1" from core.  
Tin each lead to the core

## FIG 14



Everytime the wire passes through the center of the core, you count that as one turn. Turns are always counted on the inside of the core.

## FIG 16

For illustration purposes only. Actual number of turns on core varies from coil to coil.

## **1 YEAR LIMITED WARRANTY**

**PARTS** - Replacements for defective parts will be supplied free of charge for a period of one year from the date of purchase. Replacement parts are warranted for the remaining portion of the original warranty period. If you have a defective part, you may obtain a replacement by calling us at (616) 796-0920. We will pay the shipping charges on these parts.

**SERVICE LABOR** - For a period of one year from date of purchase, any malfunction caused by defective parts will be corrected at no charge to you. You must deliver the unit at your expense to us. This warranty does not cover the correction of assembly errors or damage incurred during assembly of the kit.

**TECHNICAL CONSULTATION** - You will receive free consultation on any problem you may encounter in the assembly or use of our product. Just give us a call at (616) 796-0920, we will be glad to assist you.

**NOT COVERED** - The correction of assembly errors, adjustments, calibration, damage due to misuse, abuse or negligence are not covered by this warranty. Use of corrosive solder will void this warranty in its entirety. This warranty does not include reimbursement for inconvenience, loss of use or customer assembly.

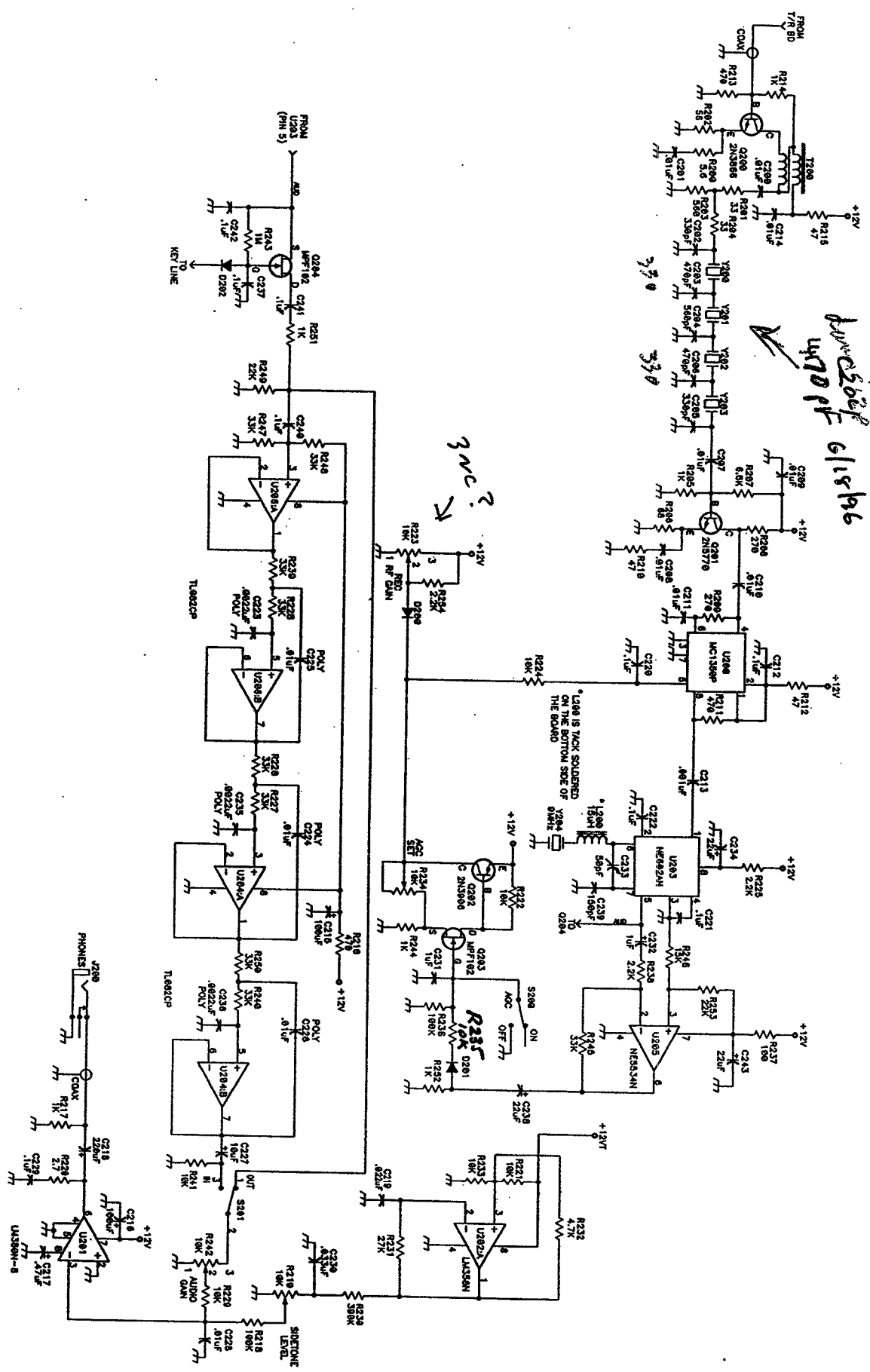
This warranty covers only Oak Hills Research products and is not extended to other equipment or components that a customer uses in conjunction with our products.

**EFFECTIVE WARRANTY DATE** - Warranty begins on the date of first consumers purchase. Please supply a copy of your invoice when you request warranty service or parts.

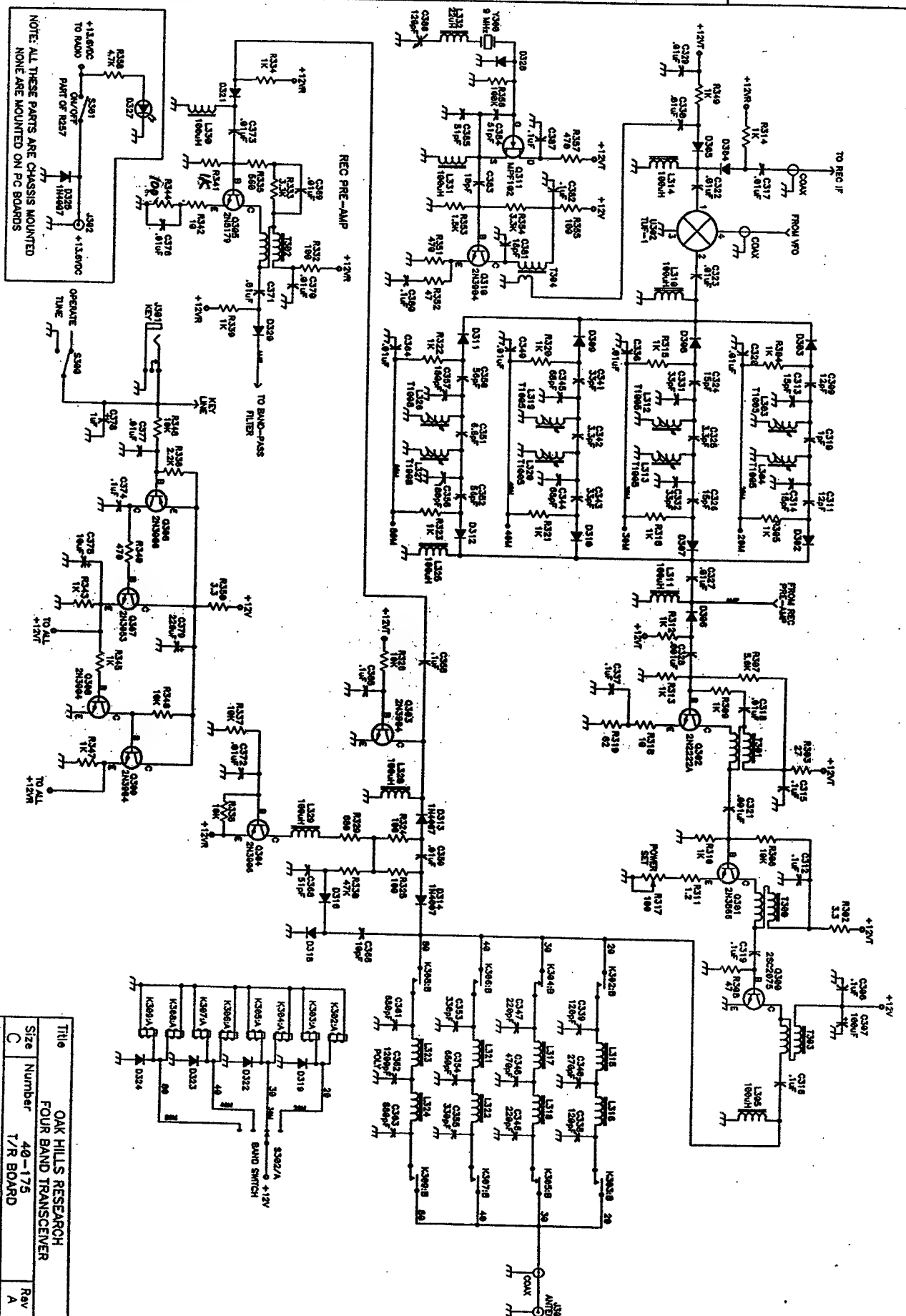
**SHIPPING UNITS** - When shipping a unit back to us for repair, use adequate packing material. Damage due to inadequate packing cannot be repaired under this warranty.

**OAK HILLS RESEARCH**  
20879 MADISON STREET  
BIG RAPIDS, MI 49307  
(616) 796-0920  
FAX (616) 796-6633  
E-Mail [grp@ohr.com](mailto:grp@ohr.com)

A B C D E

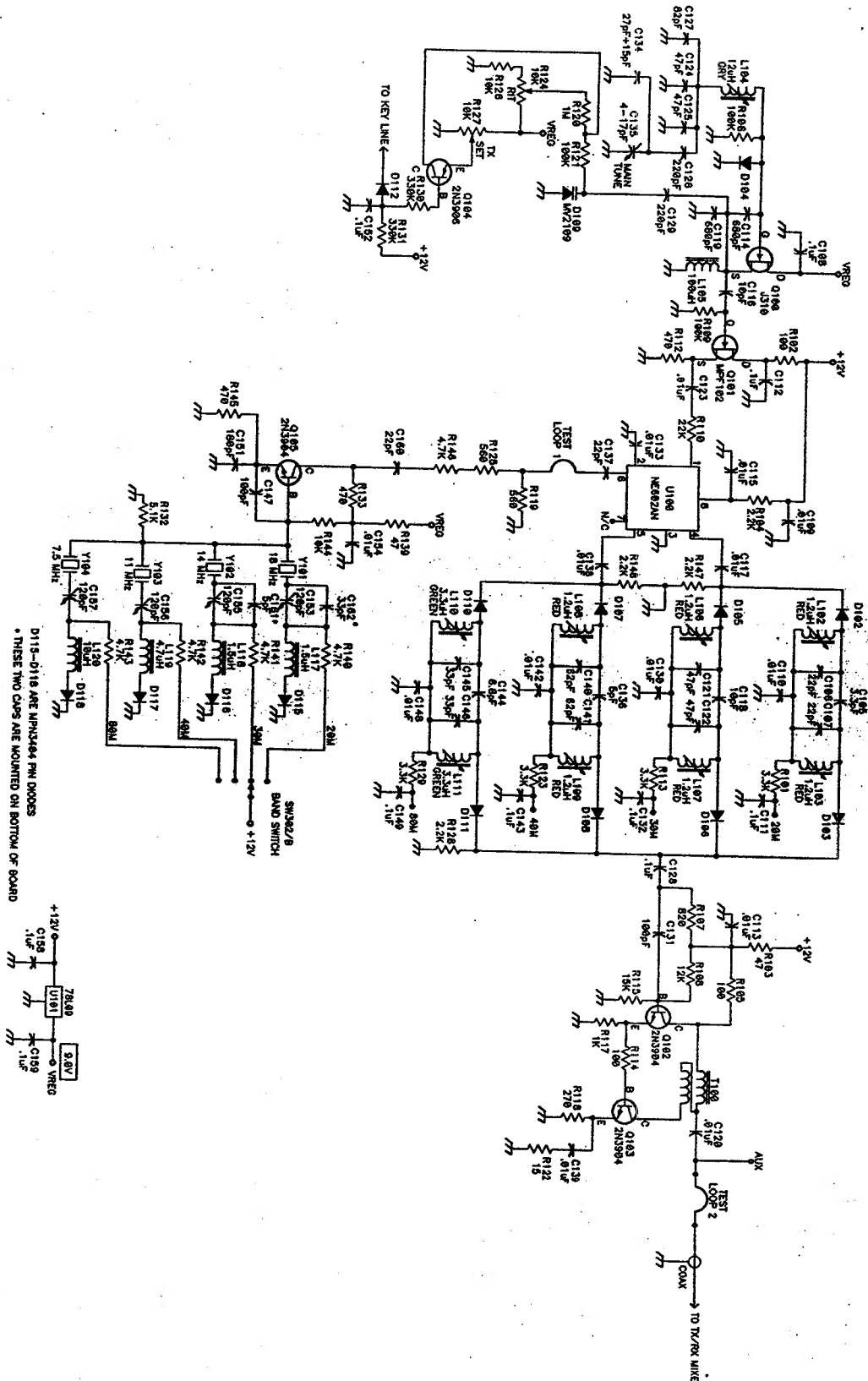


Title		OAK HILLS RESEARCH	
Size		40-177	
Number		REC BOARD	
Rev		C	
Date		12/95	
Filename		40-177.501	
Sheet		3 of 3	
Drawn by		DW	



NOTE: ALL THESE PARTS ARE CHASSIS MOUNTED  
NONE ARE MOUNTED ON PC BOARDS

Title		
OAK HILLS RESEARCH		
FOUR BAND TRANSCEIVER		
Size	Number	Rev
C	40-175	A
Date	2/95	Drawn by DW
Filename 40-175.S01 Sheet 2 of 3		



D115-D118 ARE 1N4348A PIN DIODES  
 \* THESE TWO CAPS ARE MOUNTED ON BOTTOM OF BOARD

Title		OAK HILLS RESEARCH	
Size		FOUR BAND TRANSCIVER	
Number		40-180	
Date		5/95	
Filename		40-180.S01	
Sheet		1 of 3	

34511

# PARTS PICTORIAL

A1



A2



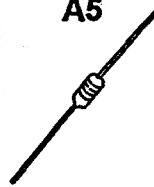
A3



A4



A5



A6



A7



A8



A9



A10



A11



A12



A13



Always count the number of pins on the socket.

B1



B2



B3



B4



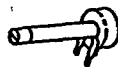
B5



B6



C1



C2



C3



C4



C5



C6



C7



C8

NO PART

C9



C10



C11



C12

NO PART

D1



D2



D3



D4



D5



# PARTS PICTORIAL

D6



D7



D8



D9



D10

NO PART

D11



D12



D13



D14



D15



D16



D17



D18



D19



D20



D21



D22



D23



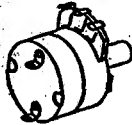
E1



E2



E3



E4



E5



E6



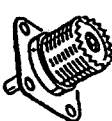
E7



E8



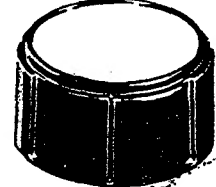
E9



E10



E11



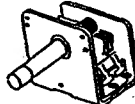
E12



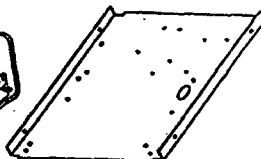
E13



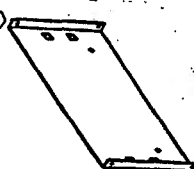
F1



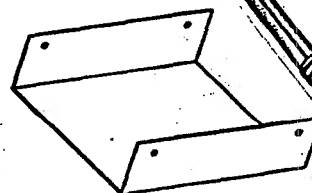
F2



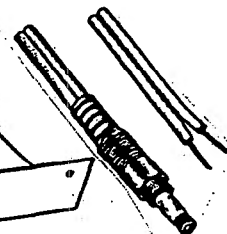
F3



F4



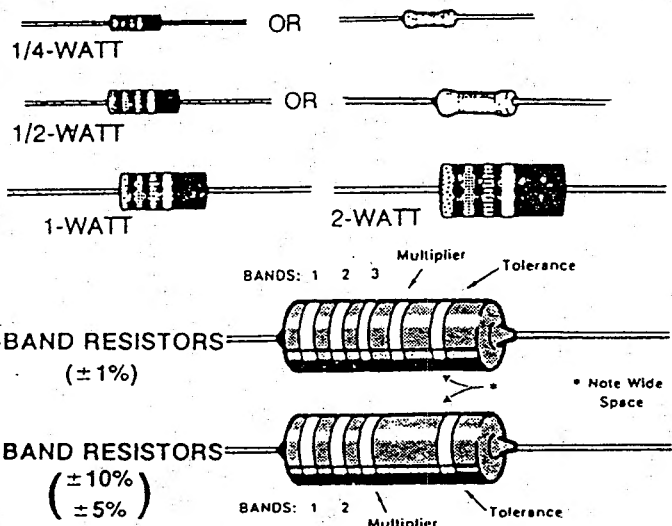
F5



G1



## RESISTORS & CHOKES



Band 1 1st Digit		Band 2 2nd Digit		Band 3 (if used) 3rd Digit		Multiplier		Resistance Tolerance	
Color	Digit	Color	Digit	Color	Digit	Color	Multiplier	Color	Tolerance
Black	0	Black	0	Black	0	Black	1	Silver	$\pm 10\%$
Brown	1	Brown	1	Brown	1	Brown	10	Gold	$\pm 5\%$
Red	2	Red	2	Red	2	Red	100	Brown	$\pm 1\%$
Orange	3	Orange	3	Orange	3	Orange	1,000		
Yellow	4	Yellow	4	Yellow	4	Yellow	10,000		
Green	5	Green	5	Green	5	Green	100,000		
Blue	6	Blue	6	Blue	6	Blue	1,000,000		
Violet	7	Violet	7	Violet	7	Silver	0.01		
Gray	8	Gray	8	Gray	8	Gold	0.1		
White	9	White	9	White	9				

### EXAMPLES:

$$151K = 15 \times 10 = 150 \text{ pF}$$

$$759 = 75 \times 0.1 = 7.5 \text{ pF}$$

NOTE: The letter "R" may be used at times to signify a decimal point: as in: 2R2 = 2.2 (pF or  $\mu\text{F}$ ).

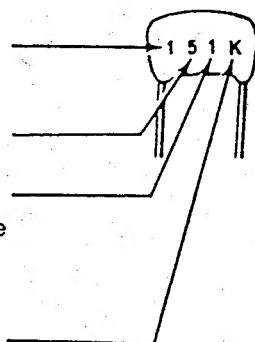
## CAPACITORS

First digit of capacitor's value: 1

Second digit of capacitor's value: 5

Multiplier: Multiply the first & second digits by the proper value from the Multiplier Chart.

To find the tolerance of the capacitor, look up this letter in the Tolerance columns.



MULTIPLIER		TOLERANCE OF CAPACITOR		
FOR THE NUMBER:	MULTIPLY BY:	10 pF OR LESS	LETTER	OVER 10 pF
0	1	$\pm 0.1 \text{ pF}$	B	
1	10	$\pm 0.25 \text{ pF}$	C	
2	100	$\pm 0.5 \text{ pF}$	D	
3	1000	$\pm 1.0 \text{ pF}$	F	$\pm 1\%$
4	10,000	$\pm 2.0 \text{ pF}$	G	$\pm 2\%$
5	100,000		H	$\pm 3\%$
			J	$\pm 5\%$
8	0.01		K	$\pm 10\%$
9	0.1		M	$\pm 20\%$